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ABSTRACT

This study provides evidence of the positive impact of library media centers (LMCs) on academic achievement in 221 Colorado public schools during the 1988-89 school year. The importance of the library media specialist's instructional role is also verified. In contrast to previous research on the relationship, this study uses schools rather than students as units of analysis, considers service outputs as well as resource inputs, and rules out the effects of selected school and community conditions which might have explained away this relationship. Highlights of the findings include: (1) where LMCs are better funded, academic achievement is higher, whether their schools and communities are rich or poor and whether adults in the community are well or poorly educated; (2) better funding for LMCs fosters academic achievement by providing students access to more library media staff and larger and more varied collections; (3) among predictors of academic achievement, the size of the LMC staff and collection is second only to the absence of at risk conditions, particularly poverty and low educational attainment among adults; (4) library media expenditures and staffing tend to rise and fall with total school expenditures and staffing; (5) students whose library media specialists participate in the instructional process are higher academic achievers. Also included in the report are a current and comprehensive annotated bibliography on this subject and a timeline chronicling the evolution of such studies. (Author/KRN)

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The Impact of School Library Media Centers on Academic Achievement

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The Impact of
School Library Media Centers on
Academic Achievement

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The Impact of
School Library Media Centers on
Academic Achievement

EXECUTIVE SUMMARY

This study provides evidence of the positive impact of library media centers on academic achievement in 221 Colorado public schools during the 1988-89 school year. In contrast to previous research on the relationship, this study uses schools rather than students as units of analysis, considers service outputs as well as resource inputs, and rules out the effects of selected school and community conditions which might have explained away this relationship.

The findings of this study indicate the importance of library media expenditures--and particularly the staff and collections they make possible--in promoting academic achievement. The importance of the library media specialist's instructional role is also verified.

Highlights:

- Where LMCs are better funded, academic achievement is higher, whether their schools and communities are rich or poor and whether adults in the community are well or poorly educated.
- Better funding for LMCs fosters academic achievement by providing students access to more library media staff and larger and more varied collections.
- Among predictors of academic achievement, the size of the LMC staff and collection is second only to the absence of at risk conditions, particularly poverty and low educational attainment among adults.
- Library media expenditures and staffing tend to rise and fall with total school expenditures and staffing.
- Students whose library media specialists participate in the instructional process are higher academic achievers.

Also included in this report are the most current and comprehensive annotated bibliography on this subject anda a timeline chronicling the evolution of such studies.

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CHAPTER 1

INTRODUCTION

School library media advocates need evidence of the links between quality library media centers (LMCs) and academic achievement. This need was demonstrated by the unprecedented publicity surrounding 1987-88 reports of a proprietary study which correlated library media expenditures and scores on norm-referenced tests.[1] Remarkably, few studies have been published on the subject over the past thirty years, and, for the most part, they only support establishing library media centers and library media specialist (LMS) positions, not strengthening them.

This study was designed to develop better empirical evidence of the impact of school library media centers on academic achievement in Colorado's public schools. It will also facilitate the development of such evidence in other states.

This first chapter identifies questions about the impact of LMCs on academic achievement for which answers will be sought, reviews previous studies on the topic, and outlines the balance of this report.

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[1] American Library Association, "Pupil success firmly linked to school library funding," *American Libraries* 18: 8 (September 1987), 632-33; Lynch, Mary Jo and Weeks, Ann, "School Match revisited," *American Libraries* 19: 6 (June 1988), 459-60.

1.1 Questions About the Impact of School Library Media Centers on Academic Achievement

Answers to three specific questions will be sought by this study:

- Is there, in fact, a relationship between expenditures on LMCs and test performance, particularly when economic differences between communities and schools are controlled? Do test scores rise and fall with the fiscal fate of library media programs?

- Assuming such a relationship, what characteristics of library media programs intervene to help to explain the relationship between expenditures on them and norm-referenced test scores? Can the number and level of LMC staff or the number of items or variety of formats in the collection be linked to test performance?

- Does the performance of an instructional role by library media specialists help to predict norm-referenced test scores? Does the amount of collaboration between library media specialists and their colleagues in the classroom affect test performance?

In pursuing answers to these three questions, this study was designed to identify schools rather than students as units of analysis, use service outputs as well as resource inputs as measures of quality, and rule out school and community differences which might explain away important relationships between LMCs and academic achievement.

This design will permit the use of readily available, aggregate data for a large number of schools statewide. It will also permit the application of rigorous statistical techniques to assess the relative importance of the many predictors under consideration. Thus, rather than simply comparing test performance by the library media "haves" and "have nots," this study will attempt to measure the impact of incremental differences in library media programs. As a result, the findings and conclusions of this study are expected to provide stronger, more compelling empirical evidence of the impact of school library media centers on academic achievement.

1.2 Review of the Literature

During the past thirty years, fewer than 40 research studies have focused on the impact of school library media centers on academic achievement. The majority of those studies (27) occurred between 1959 and 1979. Obviously, the quantitative research in this field is limited. In addition, these studies are limited in scope. Generally, a small number of subjects in a limited geographical area were examined. Often, these studies focused on one city or, at the most, a state (the exception being Gaver (1963), who looked at data from 13 states). The span of the studies was for a limited time period, generally no more than a few months. The only longitudinal study was completed by Thorne (1967) in a two-year study of students involved in the Knapp School Libraries Project. Neither of these limitations will be remedied by the design of this study. However, the study contributes several new elements to the overall field of research.

1.2.1 Presence of Library Media Center

Early studies (Willson, 1965; Yarling, 1968; Ainsworth, 1969; Becker, 1970; McConnaha, 1972) dealt with the value of the mere presence of a library, reflecting the prevalence of classroom collections and the lack of centralized library service, particularly at the elementary level.

- Willson (1965) showed that students demonstrated superior gains on the Iowa Test of Basic Skills (ITBS) in elementary schools with a centralized library and a professional librarian.

- Yarling (1968) found that the addition of a well-equipped and managed centralized library had a significant impact on the performance of elementary school students in library-related skills, particularly outlining and notetaking.

- Students who used a new fully staffed and equipped elementary school library showed significant improvement in library skills test scores in the study by Ainsworth (1969).

- Becker (1970) compared ITBS scores between students in elementary schools with and without libraries and found that the presence of a library and the guidance and function of a librarian appeared to exert significant influence on pupil achievement in some information-gathering skills areas.

- McConnaha (1972) found that the library skills test scores of high school students who had attended an elementary school with both a library and a librarian who conducted a strong library skills program were significantly higher than those who had not had a variety of library services and facilities during their elementary school experience.

1.2.2 Presence of Library Media Specialists

Other studies examined the value and role of professional staff in a library media center. (Gaver, 1963; McMillen, 1965; Hale, 1969; Wert, 1970; McConnaha, 1972; Loertscher & Land, 1975; Didier, 1982; and Loertscher, 1987). *The Millbrook Report* (1990) also confirmed the importance of staffing.

- In the study by Hale (1969), SAT scores improved among students receiving library service from a professional.

- Loertscher, Ho, and Bowie (1987) found that staffing was the single most important variable in an excellent elementary library media program. This study confirmed that critical staffing consisted of a full-time professional and a full-time clerical employee.

- Wert (1970) found that librarians without a Master's degree spent more time on clerical and housekeeping duties than those with more education. Teachers in high schools served by librarians with more extensive library education gave more assignments per class requiring use of the library.

- McMillen (1965) found that students in schools with good libraries and full-time librarians performed at higher levels in reading comprehension and in knowledge and use of reference materials than students in schools with minimal or no library service.

- Loertscher & Land (1975) concluded that full-time library media specialists gave a significantly greater level of services than either part-time professional library media specialists or full-time clerical staff.

- In questionnaires completed by high school students, Kelsey (1976) established that library services and materials were rated the highest criteria for effective library programs. The second most important criterion was the librarian, followed by atmosphere, time and schedule limitations, and physical facilities.

- Didier (1982) confirmed that student achievement in reading, study skills and use of newspapers was significantly greater at the seventh grade level in schools with professional library media personnel as compared to schools without them; and that student access to the library media center was significantly greater in schools with professional library media personnel than in schools without them.

1.2.3 Experimental Studies

A group of studies dealt with a "special treatment period" for students involving the library and measured their performance before and after that treatment.

- Bailey (1970) studied a group of disadvantaged first-grade students who participated in a library resource program over a 12-week period. The experimental group showed a significant increase in total language ability and the ability to express ideas over the control group of disadvantaged students who received no special treatment.

- DeBlauw (1973) examined the rate of cognitive growth of students on achievement test batteries before and after implementation of a multi-media program. Elementary students showed significant gains, but the academic performance of high school students was unchanged by the program.

- A longer term study of twelfth grade English students by Gilliland (1986) found that test scores on the study-locational portion of the California Assessment Program improved during the years following implementation of a library review program.

- Harmer (1959) examined the effect of library training on the summer loss or gain in reading abilities among fourth graders in Minnesota. The experimental group in the study showed some superiority in reading retention.

- Gengler (1965) looked at differences in the ability to apply selected problem solving skills between sixth grade students who were instructed by a classroom teacher and those who received additional instruction from an elementary school librarian. Findings showed that the mean score on a problem solving skills examination for the librarian-teacher instructed group was significantly higher than for the teacher instructed group.

- Hastings and Tanner (1963) looked at whether improved English language skills could be developed at the tenth-grade level through systematic library experiences rather than the traditional emphasis on formal English grammar. The group that eliminated all traditional emphasis on formal grammar and spelling and instead received systematic work in the use of library references was significantly superior to the groups which emphasized traditional work in grammar and spelling.

- In the study by Hutchinson (1982), tenth-grade students were given special library skills instruction and practice by English teachers over a two-week period. Library usage among the students increased regardless of their academic grade point averages.

- Schon (1984) and Schon, Hopkins, Everett, and Hopkins (1984-85) studied the effect of a special six-week library motivational program among elementary and junior high school students in two studies. Again, library use increased and library attitudes improved among students exposed to the special treatment.

- Eisenberg (1988) reported on a study by M. Elspeth Goodin involving high school seniors in college preparatory English classes who received a series of lessons on the research process and completed a research paper. Students in the experimental group scored significantly higher on the post-test of basic college library information than students in the control group. Students in the experimental group also produced research papers more acceptable at the college freshman level and expressed more positive attitudes toward using the college library than students in the control group.

1.2.4 Service Levels & Collection Size

A number of studies focused on service levels and collection size in relation to student achievement.

- Greve (1974) discovered that the most valuable predictor of student test scores was the number of volumes in the school library.

- Loertscher, Ho, and Bowie (1987) also emphasized the importance of collection size in the libraries of exemplary elementary schools.

- Thorne (1967) examined the reading comprehension and library skills of students using the augmented services of a Knapp Project library versus the nominal services of a second junior high school library in a two-year study. Findings revealed a significant difference in the mean gains of the experimental group over the control group in reading comprehension and library skills.

- On the other hand, Walker (1963) found no significant difference in the grade point averages of college students coming from communities with a high level of library service versus students from communities with poor or no library service available.

- Harkin (1971) found no marked differences in the academic college records of students using high school libraries with high media-student ratios and those using high school libraries with low media-student ratios.

- Ducat (1960) found little evidence that the school library played a vital role in the total program of schools investigated.

1.2.5 Student and Teacher Attitudes

Studies focusing on student or teacher attitudes toward library service were conducted by Koga and Harada (1989); el Hagrasy (1961); and Hodges and Reeves (1985).

- The study by Koga and Harada (1989) is unique in that it investigates the attitudes of students in Australia, Japan, Korea, and Thailand toward school libraries. This study found that students with a keen attitude toward learning tend to use the library more often and demonstrate better academic achievement.
- El Hagrasy (1961) established that the reading habits and library backgrounds of teachers are important in the development of reading habits and library usage of their students.
- Hodges and Reeves (1985) found that audio-visual services of school library media centers strongly correlated with indicators of student attitudes and media center use.

1.2.6 Student's Self-Concept & Librarian's Job Satisfaction

Self-concept of students was a factor in studies by Hopkins (1989), Hale (1970), Aaron (1975), and Eisenberg (1988); while Fortin (1970) measured job satisfaction of school librarians.

- Hale (1970) found that an experimental group of twelfth grade students who were given a variety of library services and resources and the opportunity to work independently under the supervision of the librarian showed "remarkable enthusiasm" for learning.
- Aaron (1975) studied a group of eighth grade students who participated in a program in which a full-time media specialist was added to the teaching team. In addition to showing significant improvement in language arts, spelling, and math computation, the students in the experimental group experienced improvement in their self-concept.
- Eisenberg (1988) reporting research done by M. Elspeth Goodin stated that students in an experimental group that received a series of lessons on the research process were consistently more positive in their feelings of confidence in using the college library than students who received no library instruction.
- Hopkins (1989) found that library media centers can play a positive role in developing positive self-concepts in children.
- Fortin (1970) confirmed that the impact of the library on the educational program was strongly related to the work satisfaction level of the librarian.

1.2.7 Textbooks vs. Library Media Materials

Barrilleaux (1965) focused on a comparison of the achievement of junior high school students in general science classes in which textbooks were used with students who used reference materials in the school library rather than a textbook. Results showed that for all investigated educational outcomes, the use of library materials without a basic textbook was the superior method of instruction. This study, completed 25 years ago, is certainly relevant in today's instructional climate with an emphasis on resource-based learning.

1.2.8 Instructional Role of Library Media Specialist

The instructional role of library media specialists was studied by Aaron (1975), nearly 15 years prior to the publication of *INFORMATION POWER.*[2] Aaron found that eighth grade students who participated in an experimental program in which a full-time media specialist was added to the teaching team showed significant improvement in language arts, spelling and math computation over the control group. Students in the experimental group also experienced improved self-confidence. Gengler (1965) also studied the impact on achievement of students receiving instruction from a classroom teacher and an elementary school librarian, and found that the mean scores for the librarian-teacher instructed group on a problem solving skills examination was significantly higher than for those in the group instructed by the teacher alone.

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[2] *INFORMATION POWER: Guidelines for School Library Media Programs* (Chicago and London: American Library Association, and Washington, D.C.: Association for Educational Communications and Technology, 1988).

1.3 SUMMARY

This Colorado study adds to the body of knowledge concerning the impact of school library media centers on academic achievement in several ways. Because of the extensive information received in the 1989 Survey of Colorado School Library Media Centers, a number of service outputs as well as resource inputs are used as measures of quality. The study also rules out school and community differences which might otherwise explain away the links between quality school library media centers and academic achievement. The instructional role of the library media specialist is examined, along with the degree of cooperative planning and teaching by school library media specialists and classroom teachers. Finally, this appears to be the only study completed to date in the 1990s.

This chapter has posed the questions which this study seeks to answer and reviewed published reports of earlier research on the issue. Chapter 2 will describe the methods of research that will be followed in this study. Chapters 3 and 4 will explain how related predictors were identified and combined to create the model of academic achievement to be tested. Chapters 5 and 6 will report how that model stood the test, identifying direct and indirect predictors of academic achievement. Chapter 7 will close this report by summarizing the findings of this research, conclusions that can be drawn from those findings, recommendations regarding limitations of this study which future researchers should strive to overcome, and practical uses to which the results of this study may be put by library media advocates.

CHAPTER 2

METHODS OF RESEARCH

The sample used in this study is composed entirely of public schools in Colorado; but, not all public schools in the state met the necessary criteria to be included in the sample. For that reason, a textbook sampling design was not possible. Yet, the bases on which schools selected themselves into (or out of) the sample appear to have had randomly distributed effects--or, at least, cancelled out each other.

This study was designed deliberately to rely upon available data. In this chapter, types of available data sought and specific data elements collected are identified and explained, as needed.

Finally, this chapter identifies and explains the various statistical techniques used to analyze the data and the criteria employed at progressive stages of the analysis.

2.1 SAMPLE

Ideally, this study would have used a random, stratified, or--at least--quota sample of Colorado schools. None of these usual sampling options was possible. To be included in the sample, four sets of data on a school were required: 1980 U.S. Census data for its school district, 1988-89 building-level school statistics, 1988-89 data on its library media center, and selected 1989 scores from the Iowa Tests of Basic Skills (ITBS) or the Tests of Achievement and Proficiency (TAP).

U.S. Census data were readily available from the Colorado Division of Local Government (the state data center), and building-level school statistics from the Colorado Department of Education's Planning and Evaluation Unit. Due to the two remaining sets of data, however, the sample for this study was largely self-selected. Schools may or may not have chosen to participate in the survey of library media centers, and districts may or may not have chosen to use the ITBS or TAP to measure academic achievement. As a result of these self-selection criteria, only 221 of 1,331 schools--or 17 percent--provided all data required to be included in the sample.

The necessity of employing a self-selected sample raises profound questions regarding the generalizability of the findings of this study. The basic question is: Do the schools included in the sample represent all public schools in Colorado? Three more precise questions follow from that one: Are schools of different levels (elementary, middle, etc.) over- or under-represented in the sample? Are schools in different enrollment ranges over- or under-represented in the sample? Are school districts in different settings (urban/suburban, outlying, rural, etc.) over-or under-represented in the sample? These three specific concerns were addressed.

2.1.1 SCHOOL LEVEL

The Colorado Department of Education recognizes five levels of schools:

- **Elementary** schools may begin as early as pre-kindergarten and generally include fifth or sixth grade. These schools may be sub-divided: for example, one serving grades one through three, another grades four through six.

- **Middle** schools usually include three to four grades, beginning as early as fifth grade but usually going no higher than ninth grade.

- **Junior high** schools usually include two or three grades, usually seventh and eighth grades, and sometimes ninth grade.

- **High** schools usually include three to four grades, beginning as early as ninth grade and ending with twelfth grade.

- **Other** schools may include any of a variety of configurations, including combined junior-senior high schools, one-building K-12 schools, and specialized schools designed to address the needs of particular groups of students.

The two following tables compare the distribution of schools in the sample with the distributions of all Colorado schools and all U.S. schools by level.

Table 2-1 compares the distribution of Colorado's public schools by level with the sample distribution:

TABLE 2-1
COLORADO & SAMPLE SCHOOLS BY LEVEL, 1988-89

Schools by Level	Colorado		Sample	
	Number	Percent	Number	Percent
Elementary	808	61%	134	61%
Middle	129	10%	24	11%
Junior High	99	7%	15	7%
Senior High	247	19%	47	21%
Other	48	4%	1	0%
Total	1,331	100%	221	100%

Source: Colorado Education Directory (Denver: Colorado Department of Education, 1989).

The figures reported in Table 2-1 indicate that schools of different levels are represented in the sample in almost the identical proportions found in the total universe of Colorado public schools. Only "other" schools are somewhat under-represented in the sample.

Table 2-2 compares the distribution of U.S. public schools by level with the sample distribution:

TABLE 2-2
U.S. & SAMPLE SCHOOLS BY LEVEL, 1988-89

Schools by Level	U.S.		Sample	
	Number	Percent	Number	Percent
Elementary	51,339	62%	134	61%
Middle	7,957	10%	24	11%
Junior High	4,687	6%	15	7%
Senior High	11,350	14%	47	21%
Other	7,832	9%	1	0%
Total	82,081	100%	221	100%

Sources: *Digest of Education Statistics* (Washington, D.C.: National Center for Education Statistics, 1991), Colorado Education Directory (Denver: Colorado Department of Education, 1989).

The figures reported in Table 2-2 indicate that schools of different levels are represented in the sample in very similar proportions to those found in the total universe of U.S. public schools. Senior high schools are over-represented, however, at the expense of "other" schools.

2.1.2 ENROLLMENT RANGE

The next two tables compare the distribution of schools in the sample with the distributions of all Colorado schools and all U.S. schools by enrollment range.

Table 2-3 compares the distribution of Colorado's public schools by enrollment range with the sample distribution:

TABLE 2-3
COLORADO & SAMPLE SCHOOLS BY ENROLLMENT RANGE, FALL 1988

Schools by Enrollment Range	Colorado		Sample	
	Number	Percent	Number	Percent
1,000 & over	77	6%	20	9%
700-999	102	8%	25	11%
500-699	253	19%	40	18%
300-499	429	32%	73	33%
under 300	470	35%	63	29%
TOTAL	1,331	100%	221	100%

Source: Colorado Department of Education computer files.

The figures reported in Table 2-3 indicate that schools of different sizes are represented in the sample in almost identical proportions to those found in the total universe of Colorado public schools. With the exception of schools with enrollments under 300, variations for other categories are only one or two percentage points.

Table 2-4 compares the distribution of U.S. public schools by enrollment range with the sample distribution:

TABLE 2-4
U.S. & SAMPLE SCHOOLS BY ENROLLMENT RANGE, 1988-90

Schools by Enrollment Range	U.S., 1989-90		Sample, Fall 1988	
	Number	Percent	Number	Percent
1,000 & over	6,674	8%	20	9%
700-999	10,011	12%	25	11%
500-699	16,685	20%	40	18%
300-499	23,359	28%	73	33%
under 300	26,696	32%	63	29%
TOTAL	83,425	100%	221	100%

Sources: Digest of Education Statistics (Washington, D.C.: National Center for Education Statistics, 1991), Colorado Department of Education computer files.

The figures reported in Table 2-4 indicate that schools of different sizes are represented in the sample in very similar proportions to those found in the total universe of U.S. public schools. Schools with enrollments under 500 are very slightly over-represented in the sample.

2.1.3 SCHOOL DISTRICT SETTING

The Colorado Department of Education assigns school districts to one of seven setting categories. For purposes of this research, these seven categories are collapsed into five:[3]

- **Urban/suburban** districts are those which comprise the state's major population centers--both inside and outside the Denver metropolitan area--and their immediately surrounding suburbs. These districts are within areas characterized by population centers of 30,000 persons or more.

- **Outlying** districts are those in which most pupils live in population centers of at least 1,000 but less than 30,000 persons.

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[3] *Foothold on the Future: K-12 Public Education in Colorado: 1989 Progress Report* (Denver: Colorado Department of Education, 1989).

- **Rural** districts are those with no population centers in excess of 1,000 persons and characterized by sparse, widespread populations. These districts also do not meet the economic criteria for the recreational category or the enrollment criteria for the small attendance category.

- **Recreational** districts are those which contain major recreational developments that impact the cost of property values, community income, and cost-of-living generally.

- **Small attendance** districts are those which are rural in nature and which have pupil enrollments of less than 150.

These setting types are unique to Colorado; so, the distribution of school districts by these settings can only be compared with the distribution of all Colorado school districts. Table 2-5 reports this comparison:

TABLE 2-5
COLORADO & SAMPLE DISTRICTS BY SETTING CATEGORY, 1989

Districts by Setting Category	Colorado		Sample	
	Number	Percent	Number	Percent
Urban/Suburban	30	17%	7	21%
Outlying	56	32%	10	30%
Rural	55	31%	10	30%
Recreational	6	3%	1	3%
Small Attendance	29	16%	5	15%
Total	176	100%	33	100%

Source: *Foothold on the Future: K-12 Public Education in Colorado: 1989 Progress Report* (Denver: Colorado Department of Education, 1989).

The figures reported in Table 2-5 indicate that school districts in different settings are represented in the sample in almost identical proportions to those found in the total universe of Colorado school districts.

On the basis of these three comparisons, the two self-selection criteria involved in this study are deemed not to have biased the sample. Schools selected themselves into the sample by participating in the 1988-89 survey of library media centers. These schools are distributed by level and enrollment range in proportions comparable to those for all Colorado public schools. Districts selected themselves into the sample by utilizing the ITBS and TAP as measures of academic achievement. These districts are distributed by setting in proportions comparable to those for all Colorado school districts.

2.2 DATA

This study relies entirely upon norm-referenced test scores as measures of academic achievement and available data about school library media centers and their school and community contexts as predictors of such achievement.

Certain limitations of these data should be acknowledged at the outset of this discussion:

- Educational assessment is in the process of being restructured away from conventional norm-referenced testing. This change is occurring largely because of the questionable validity of such tests. Many question whether the tests actually measure academic achievement--or, at least, whether they measure it with sufficient impartiality toward all groups of students. At the time of this study, however, no alternative to norm-referenced testing was in place. The ITBS in particular was chosen because of its prevalence in Colorado at the time under study and its prominence in the extant literature on the impact of school library media programs on academic achievement.

- Data from the 1980 U.S. Census--sometimes the only data available on certain demographic and economic characteristics--are quite dated. This problem was mitigated to a large extent by supplementing these data with similar or proxy measures for which more contemporary data were available from the Colorado Department of Education.

- Both U.S. Census data and figures on per pupil expenditures were available only at the district level. All other data involved in this study are for the building level. While the necessity of utilizing district level data on certain variables limited their variation from case to case, the findings indicate that this dampening effect was not so powerful as to mask their importance.

2.2.1 COMMUNITY VARIABLES

Many community data were drawn from the school district files of the 1980 U.S. Census. Because other data involved in this study are for the 1988-89 school year, it would have been preferable to have more current data on the communities in which schools were located; but, even with the delays experienced during this study, 1990 U.S. Census data for school districts were not available. These community data elements include:

- percentages of the district population living in urbanized and rural areas,
- percentages of district residents age 25 and over who graduated from high school and who completed four or more years of college,
- average family size,
- median family income, and
- the percentage of families residing in the district living below poverty level.

Additional community data were drawn from the computerized files of the Colorado Department of Education's Planning and Evaluation Unit. These two data elements include:

- the percentages of a school's students in various racial/ethnic groups (e.g., Blacks, Hispanics, Native Americans, Asians), and
- the percentage of a school's students who participate in the National School Lunch Program (a proxy measure of socio-economic status).[4]

While these statistics were captured and reported by the school, they reflected demographic and economic conditions in the community rather than conditions created by the schools. These data were a valuable supplement to U.S. Census data, because the school statistics are both more specific geographically and more contemporaneous with other data in the study.

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[4] According to *Child Nutrition Programs*, a brochure produced by the Colorado Department of Education's Child Nutrition Unit, "The National School Lunch Program ... offers basic financial assistance, USDA-donated foods, and additional reimbursement for each lunch served free or at a reduced price to eligible children." Eligibility criteria make the count of students participating in this program a proxy measure of socio-economic status.

2.2.2 SCHOOL VARIABLES

Likewise, data characterizing schools were drawn from the computerized files of the Colorado Department of Education's Planning and Evaluation Unit. By contrast with the demographic and economic figures drawn from those files, these data reflect conditions within the school and under the control or influence of school or district officials. These data elements include: the pupil-teacher ratio, the percentage of teachers with Master's degrees, average years of experience for teachers in each school, and average salary for teachers in each school.

Added to these building-level data on teachers were fiscal data for their school districts drawn from *Colorado School Districts and Bureaus of Cooperative Services Revenues and Expenditures for 1989*, an annual report of the Colorado Department of Education's School Finance Unit. These data elements include: total school expenditures per pupil, and expenditures per pupil in four categories: instruction, supplies and materials (a subcategory of instruction), support services, and community services.[5]

Of course, there are many other school characteristics which might help to explain academic achievement. Aside from fiscal data, school variables in this analysis focus on the most available data regarding teachers. These data elements are the ones for which figures were readily available for all schools in the sample.

The critical school variable for this analysis was total expenditures per pupil. The easiest argument to make against unsubstantiated claims of a correlation between library media expenditures and test performance is that the correlation is a spurious result of richer schools being able to spend more on all kinds of programs that might foster higher test scores--only one of which might be the library media program. With this variable, it is possible to isolate expenditures for library media materials from other per pupil expenditures.

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[5] *Colorado School Districts and Boards of Cooperative Services Revenues and Expenditures for 1989* reports audited financial information based on the October 1988 Funded Pupil Count, including expenditures in four major categories: instruction, support services, community services, and other. Expenditures on instruction include salaries, employee benefits, purchased services, supplies and materials (including textbooks and library media center materials), capital outlay, and other instructional expenses. Expenditures on support services include those on pupil and instructional staff support, general and school administration, operations and maintenance, pupil transportation and food services, and other support services. Expenditures on community services include those for services other than public school and adult education functions provided by the school for purposes relating to the community as a whole or some segment of the community. These include such services as community recreation programs, civic activities, public libraries, child care, community welfare, and services for non-public school students provided on a continuing basis.

2.2.3 LIBRARY MEDIA VARIABLES

Almost half of Colorado's school library media centers (LMCs)--624 of 1,331--responded to the state library's 1988-89 survey. (The survey instrument appears in Appendix B.) Each of those LMCs reported a variety of data, including:

- the number of hours per typical week the LMC is staffed by a state-endorsed school library media specialist,[6]
- the number of hours per typical week spent by library media staff identifying materials for curriculum developed by teachers,
- the number of hours per typical week spent by library media staff collaborating with teachers on curriculum development,
- the total number of staff hours per typical week (a duplicated count),
- numbers of items held in the collection by format (books, periodical subscriptions, videos, computer software packages, audio-visual materials),
- the number of microcomputers in or under the jurisdiction of the LMC,
- print and non-print circulation per typical week,
- the number of materials (print or non-print) outside the local collection borrowed or rented per typical week,
- individual instructional uses of microcomputers per typical week, and
- individuals contacted for information skills instruction (whether individually or in groups) per typical week.

These data provide at least rudimentary measures of an LMC's levels of staffing, collection development, and involvement in curriculum development, instruction, and computer technology.

The survey also requested a count of individual library visits per typical week; however, responses to that item were deemed invalid and, therefore, not useful for purposes of this study.

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[6] As reported in *Colorado Information Power: Guidelines for School Library Media Programs 1989* (p. 63), schools are required to hire certified staff to manage all educational programs, including the school library media center. In addition to teacher certification, a library media specialist is required to have at least 18 semester hours of graduate or upper-division undergraduate credit in the basic area of print or non-print media. Library media specialists have both managerial and instructional roles. They are responsible for planning, implementing, and evaluating library media service and for teaching and planning learning experiences conducted by library support staff.

2.2.4 TEST SCORES

The dependent variable for this study, academic achievement, is represented by scores on selected components of the *Iowa Tests of Basic Skills* (ITBS) and *Tests of Achievement and Proficiency* (TAP). Test scores were averaged by school by grade. Based on criteria of availability and comparability, scores for six grades are included: grades one, two, four, five, and seven, all from the ITBS; and tenth grade from the TAP.

Third grade was excluded from this study on grounds of comparability. Some districts assign first and second grades to one building and third through sixth to another. Other districts assign first through third grades to one building and fourth through sixth to another. In addition, there is an historical influence for some schools in the sample, which had moved third grade from one building to another during the year under study. Altogether, these circumstances were deemed to make third grade ITBS scores non-comparable for purposes of this research.

Similarly, sixth grade scores were excluded, because, in some districts, this grade is located in elementary schools, while in others, it is located in middle schools.

At the secondary level, seventh and tenth grades were selected over others on the grounds of greater availability.

Notably, test scores are the only data reported by grade. It was not practically possible to obtain by grade other data, such as total expenditures per pupil or LMC staff or collection size.

For grades one, two, four, five, and seven, the three tests are: Reading, Language, and Work-Study Skills. For tenth grade, the three tests are: Reading, Written Expression, and Using Sources of Information. These three types of test scores were chosen both for their intuitive appeal in terms of the likely impact of library media service on them and because of their use in earlier research on the impact of school library media programs.

Spring test scores for the 1988-89 school year were ordered or requested from three sources:

- test scores were purchased from Riverside Publishing Company, the ITBS/TAP publisher, for districts with multiple schools and for whom Riverside scored the tests;[7]
- test scores were obtained directly from selected school districts which scored the test themselves; and
- test scores for small districts in which district-level scores were also building-level scores were obtained from the Colorado Department of Education Resource Center files.

To ensure that this variable met the criterion of interval-level data required for multiple regression and path analysis, national percentile ranks or grade equivalent scores were converted to developmental standard scores.[8]

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[7] To purchase test scores from the publisher, one must obtain the written permission of districts or schools for which scores are sought. For this reason--and because the tests are not necessarily scored by the publisher--it will be less time-consuming and costly for future researchers to obtain scores directly from districts or schools under study.

[8] Frequently, developmental standard scores (DSS) were obtainable directly. Given national percentile ranks on the ITBS, however, their conversion was accomplished by referring to Tables 6 and 3 in *Iowa Tests of Basic Skills: National Norms for Forms G and H: Levels 5-14* (1986). Converting TAP scores, when necessary, was much simpler, requiring referral to a single table in Section 7 of *Tests of Achievement and Proficiency: Teacher's Guide: Multilevel Battery, Levels 15-18: TAP Forms G/H* (1986).

2.3 ANALYTICAL TECHNIQUES

The goals of this study were to develop and test a model of academic achievement and to determine the importance of library media centers in such a model. That model was constructed and tested using three statistical techniques: correlation analysis, factor analysis, and path analysis via multiple regression. Each of these techniques contributed to the model's refinement in a different way.

2.3.1 CORRELATION ANALYSIS

The first statistical technique used was correlation analysis. This technique helped to identify redundant variables to be eliminated and related ones to be combined.

A correlation matrix was generated for each set of variables. Each matrix provided Pearson's correlation coefficient (r) for each pair of variables in a set. This figure indicates the strength and direction of the relationship between the two variables. The coefficient falls between .00 and 1.00. The higher this figure, the stronger the relationship between the two variables. If the figure is preceded by a minus sign (-), the relationship is negative. As values on one variable fall, values on the other variable rise. If the figure is not preceded by a minus, the relationship is positive. Values on the two variables rise or fall together.

These correlation coefficients helped to determine if any data elements were so strongly associated as to be problematic. In making that decision, three generally accepted criteria were followed:

- If r was under .60, both variables were at least initially retained.
- If r was over .80, the one with the lower r's for the larger number of other variables was retained, and the other discarded.
- If r was between .60 and .80, an attempt was made to combine the variables either by addition or factor analysis.

2.3.2 FACTOR ANALYSIS

While correlation analysis examines relationships between pairs of variables, factor analysis establishes relationships among groups of related variables. This technique was particularly useful when two or more variables needed to be combined, but were measured on different scales (e.g., dollars and percentages).

Instead of reporting the correlation of each variable with each other variable, factor analysis creates artificial factors and reports factor loadings which indicate how strongly and in what direction each variable is related to each factor. A factor loading indicates how much weight is assigned to a given factor for a given variable. Factors on which a variable loads highly are closely related to that variable. At this stage, factor analysis was a more efficient method of confirming--and discovering--relationships among variables than comparing multiple relationships among pairs of variables.

Exactly how factor analysis works need not be understood. When sorted by factor, the results are easy to interpret, since a researcher can readily identify variables which load highly on a given factor. The researcher, however, must interpret what a factor represents and decide what to call it. The factor analysis technique will also generate a factor score based on a school's values on the variables which load on a factor. In several instances, closely related variables were replaced by a factor score.

2.3.3 PATH ANALYSIS VIA MULTIPLE REGRESSION

The third statistical technique, multiple regression, was used to test the model of academic achievement. This technique is especially useful in assessing complex relationships among several potential predictors, because it weighs the importance of each predictor variable while ruling out the effects of the others.

This application of multiple regression techniques is a path analysis because both research and practice suggest a certain cause-and-effect order among the variables. In this model, community variables precede school variables, and school variables precede library media variables. All three sets of predictors precede--and may affect directly and/or indirectly--academic achievement. Multiple regression is used to assess the strength and direction of each separate path from variable to variable. These relationships are reported as path coefficients (i.e., betas or standardized regression coefficients).

Correlation and factor analyses of the original data elements refined the model by eliminating redundant variables and combining those which were so closely related as to produce statistical "static." In a path analysis via multiple regression, such "noise" complicates a model unnecessarily and suppresses the effects other predictors artificially.

It is very important to note that path analysis makes two kinds of assumptions. It assumes causal order. The presumed cause-and-effect order in this model is suggested by previous research and practical experience. It is intuitively obvious that the status of library media centers may depend on more general school circumstances, just as they, in turn, may be driven by community conditions. It is equally apparent, however, that each of these sets of variables may affect academic achievement either directly or indirectly via some other variable not represented in this model.

An assumption of causal closure supposes that no critical variables are omitted from the model. This assumption presents some problems for this study. Without apology, its focus in on assessing the impact of school library media centers on academic achievement. The community and school variables included represent major antecedent conditions which might explain away that impact. The possibility that a correlation between high library media expenditures and test scores might be a spurious result of high per pupil spending in general was addressed by including the latter variable. Similarly, the possibility that a correlation between library media expenditures and test scores might be a spurious result of community affluence or socio-economic advantages was addressed by including several alternative measures of those variables.

Because the original number of variables was large, it is assumed that an acceptable degree of causal closure was established. Nonetheless, Multiple R Squared (R^2) is taken as a sufficient statistical indicator of the extent to which the model may not be causally closed. This statistic indicates the percentage of variation in test scores which is explained by a given group of predictors.

Separate analyses were conducted for six grades: first, second, fourth, fifth, seventh, and tenth. In each case, multiple regression was used to generate initial path coefficients. Variables whose path coefficients were less than .10 and which were not statistically significant at least the .05 level (generally accepted standards) were automatically eliminated from the analysis.

In assessing the overall model, direct relationships between potential predictors and test scores not demonstrated consistently in a majority of grades were discounted and attributed to unknown cohort effects. (The relocation of third grade students between lower and upper elementary schools mentioned earlier is an example of a known cohort effect.)

After the direct effects of all variables on test scores were recalculated, indirect effects from community to school to library media center were calculated.

2.4 SUMMARY

This chapter has described the largely self-selected, but nonetheless representative, sample of Colorado schools involved in this study; identified the variety of variables and available data used in constructing a model of academic achievement; and explained the different statistical techniques used in testing it. The next two chapters report the uses of correlation and factor analyses to refine the model. The following two chapters report the results of the path analysis which identified and weighed the direct and indirect effects of variables remaining in the model on academic achievement.

CHAPTER 3

IDENTIFYING RELATED PREDICTORS OF ACADEMIC ACHIEVEMENT

The previous chapter described the methods of research used in this study to assess the impact of school library media centers on academic achievement. This third chapter presents the results of a series of correlation analyses. These results guided the first stage of the data reduction process by providing bases for eliminating redundant variables and suggesting relationships among variables that might be combined.

This study involves norm-referenced test scores and three sets of potential predictors--selected available data on library media centers, the schools in which those centers operate, and the communities served by those schools. Relationships among variables within the same category of data are assumed; but, with the exception of the library media data set, they are not the primary concern of this study. The focus of this research is on establishing relationships between potential community, school, and library media predictors and test scores. Therefore, relationships among these four sets of potential predictors of test scores are examined separately.

In addition to assessing relationships within each set of predictors, this chapter reports on relationships found among the three types of test scores being predicted.

3.1 COMMUNITY VARIABLES

The community context of schools and library media centers was first examined by analyzing relationships among nine variables. These nine include seven from the 1980 U.S. Census:

- the percentage of the district population residing in urbanized areas (URBAN),
- the percentage of the district population residing in rural areas (RURAL),
- the percentage of district residents age 25 and over who graduated from high school (HSGRAD),
- the percentage of district residents age 25 and over who completed at least four years of college (COLLGRAD),
- average family size (FAMSIZE),
- median family income (INCOME), and
- the percentage of families residing in the district living below poverty level (POVERTY).

Two additional variables collected for the 1988-89 school year by the Colorado Department of Education are:

- the percentage of the school's students in selected racial/ethnic groups (MINORITY), and
- the percentage of the school's students who participate in the National School Lunch Program--a proxy measure of socio-economic status (FREELNCH).

3.1.1 FINDINGS

Table 3-1 reports the correlation matrix generated for this set of variables. Several problematically high correlations were identified:

- **Rural and urbanized populations within school districts are almost mutually exclusive.** Percentages of the district population residing in rural and urbanized areas (RURAL and URBAN, respectively) have a correlation coefficient of -.91 which is statistically significant at the .001 level (hereafter $p<.001$).

Notably, the second of these variables deals with urbanized areas. Such areas consist of an incorporated place and adjacent densely settled surrounding area that together have a minimum population of 50,000.[9] Urbanized areas, therefore, are the most urban parts of the state, not simply the inverse of rural areas (i.e., places with populations less than 2,500). Thus, this high and significant correlation between rural and urbanized populations reflects the peculiar demography of Colorado. Most of the state's population is concentrated in metropolitan and rural or resort areas, leaving little in-between.

Because Colorado's population is distributed in such an extreme and exaggerated fashion, the distribution of RURAL was examined for the amount of variation it offered. This distribution is summarized in Table 3-2.

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[9] U.S. Bureau of the Census, *1980 Census of Population: Volume 1: Characteristics of the Population: General Social and Economic Characteristics: Colorado* (Washington, DC: U.S. Government Printing Office, 1983), p. A-2.

TABLE 3-1
CORRELATION MATRIX FOR COMMUNITY VARIABLES

Correlations	RURAL	URBAN	FAMSIZE	MINORITY	FREELNCH	HSGRAD	COLLGRAD	INCOME	POVERTY
RURAL	1.00								
URBAN	-.91**	1.00							
FAMSIZE	.14	-.16	1.00						
MINORITY	-.42**	.39**	-.28**	1.00					
FREELNCH	-.01	.01	-.20**	.48	1.00				
HSGRAD	-.42**	.47**	-.02	-.39**	-.39**	1.00			
COLLGRAD	-.52**	.52**	-.19*	-.12	-.31**	.86**	1.00		
INCOME	-.51**	.55**	.18*	-.31**	-.38**	.88**	.80**	1.00	
POVERTY	.27**	-.27**	-.30**	.52**	.37**	-.72**	-.47**	-.79**	1.00

Minimum pairwise N = 219

Significance levels * = .01 ** = .001

Legend

RURAL	Percent of district population living in rural areas, 1980
URBAN	Percent of district population living in urbanized areas, 1980
FAMSIZE	Average family size for school district, 1980
MINORITY	Percent of pupils in school identified as Hispanic, Black, Asian/Pacific, or Native American, Fall 1989
FREELNCH	Percent of pupils in school participating in National School Lunch Program, Fall 1989
HSGRAD	Percent of persons age 25 and over who graduated from high school, 1980
COLLGRAD	Percent of persons age 25 and over who completed four or more years of college, 1980
INCOME	Median family income for school district, 1980
POVERTY	Percent of families living below poverty level, 1979

TABLE 3-2
DISTRIBUTION OF RURAL VARIABLE

Statistic Value	Frequency	Percent	Cumulative Percent
0.00	80	36.2	36.2
0.01-0.99	89	40.2	76.4
1.00	52	23.6	100.0
TOTAL	221	100.0	

These findings indicate that the amount of variation offered by RURAL is extremely meager. Of the total sample involved in the study, three out of five schools were in districts with no rural population or 100 percent rural population. Only two cases out of five offered some variation between those extremes.

Three additional findings indicate the very close relationship between educational attainment and income. Predictably, those who graduated from high school and college tended to have higher family incomes.

- **Where more adults have graduated from high school, family incomes are higher.** The percentage of residents age 25 and over who graduated from high school (HSGRAD) and median family income (INCOME) have a correlation coefficient of .88 ($p<.001$).

- **Where more adults have graduated from high school, more adults are likely to graduate from college.** Percentages of residents age 25 and over who graduated from high school (HSGRAD) and who completed four or more years of college (COLLGRAD) have a correlation of .88 ($p<.001$).

- **Where more adults have graduated from college, family incomes are higher.** The percentage of residents age 25 and over who completed four or more years of college (COLLGRAD) and median family income (INCOME) have a correlation of .80 ($p<.001$).

Two more findings indicate close relationships between poverty status, income level, and educational attainment which certainly are not news, but bear remembering.

- **Where family incomes are lower, more families live in poverty.** The percentage of families living below poverty level (POVERTY) and median family income (INCOME) have a correlation of -.79 ($p<.001$).

- **Where fewer adults are high school graduates, more families live in poverty.** The percentage of families living below poverty level (POVERTY) and the percentage of residents age 25 and over who graduated from high school (HSGRAD) have a correlation of -.72 ($p<.001$).

3.1.2 ACTIONS

On the basis of these findings, the following actions were taken:

- **Both URBAN--the percentage of the district population residing in urbanized areas--and RURAL--the percentage residing in rural areas--were dropped.**

The extremely high and significant correlation between these two variables made it imperative to eliminate at least one of them to avoid serious statistical "static." Colorado has few urbanized areas and many areas with either no or entirely rural populations. In addition, the small degree of urban-rural variation that exists would have to be further subdivided according to the grades tested by schools in those areas. Consequently, these variables were discarded as offering too little variation to be useful in this type of statistical analysis.

- **Of the three variables, HSGRAD, COLLGRAD, and INCOME, the college graduation and median family income variables were discarded in favor of the high school graduation variable.**

This decision is based on the fact that the latter variable has lower correlations with most other community variables than the former ones.

- **POVERTY was discarded in favor of FREELNCH.**

The correlation coefficient between these two variables is only .37, although it is statistically significant at the .001 level. Conceptually, these variables are close, if not identical. It is assumed, therefore, that the relatively weak correlation between them is attributable to the differences in time and geography between them. POVERTY is the percentage of families residing in the district living below poverty level in 1979, while FREELNCH is the percentage of a school's students participating in the National School Lunch Program during the 1988-89 school year.

- **Having eliminated the problem between INCOME and POVERTY, the issue of the high correlation between HSGRAD and POVERTY is passed on to the factor analysis stage.**

3.2 SCHOOL VARIABLES

Two sets of school variables are involved in this study: four are related to a school's teachers and five are related to district expenditures, both total and in selected categories. The four school variables relating to teachers are:

- the teacher-pupil ratio (TPRATIO),
- the percentage of a school's teachers who have Master's degrees (TMASTERS),
- average salary for a school's teachers (TAVGPAY), and
- average years of experience for a school's teachers (TAVGEXP).

The five variables relating to district expenditures are:

- instructional expenditures per pupil (INSTEXPS),
- per pupil expenditures for supplies and materials (SUPMEXPS),
- per pupil expenditures for support services (SUPTEXPS),
- per pupil expenditures for community services (COMMEXPS), and
- total expenditures per pupil (EXPTOTAL).

3.2.1 FINDINGS

Table 3-3 reports the correlation matrix generated for this set of variables. Several problematically high correlations were identified:

- **Schools with more teachers with Master's degrees tend to pay higher salaries.** The percentage of a school's teachers with Master's degrees (TMASTERS) and the school 's average salary for teachers (TAVGPAY) have a correlation coefficient of .72 which is statistically significant at the .001 level (hereafter $p<.001$). This relatively high correlation suggests that teachers with Master's degrees tend to be paid more highly than those who have not completed such degrees.

- **Schools which spend more on instruction in general almost always spend more on supplies and materials that support instruction.** Instructional expenditures per pupil (INSTEXPS) and its sub-set, per pupil expenditures for supplies and materials (SUPMEXPS), have a virtually perfect correlation of .99 ($p<.001$). The likely explanation is the fact that the state mandates that a certain percentage of instructional dollars go for supplies and materials.

- **Schools which spend more on instruction in general also almost always spend more on support services.** The same near-perfect correlation exists between per pupil expenditures for supplies and materials (SUPMEXPS) and support services (SUPTEXPS). Notably, however, this correlation is not statistically significant.

- **Schools which spend more on support services tend to spend more on community services.** Per pupil expenditures for support services (SUPTEXPS) and community services (COMMEXPS) have a correlation coefficient of .77 (p<.001).

- **Schools which spend more on instructional supplies and materials may tend to spend more on community services.** Per pupil expenditures for supplies and materials (SUPMEXPS) and community services (COMMEXPS) have a correlation coefficient of .74; but, it is not statistically significant.

These findings indicate that the detailed categories of per pupil expenditures are, for the most part, both strongly and significantly related.

3.2.2 ACTIONS

On the basis of these findings, the following actions were taken:

- **An attempt will be made to combine four variables related to teachers:**
  - ☐ the ratio of teachers to pupils,
  - ☐ the percentage of a school's teachers with Master's degrees,
  - ☐ the average salary for a school's teachers, and
  - ☐ the average years of experience for a school's teachers.

To that end, the variables, TPRATIO, TMASTERS, TAVGPAY, and TAVGEXP, were passed on to the factor analysis stage. Strictly speaking, only TMASTERS and TAVGPAY have a problematically high correlation with each other (.72, p<.001). Nonetheless, it seemed reasonable to suspect that these four teacher-related variables might coalesce into a single meaningful factor.

- Per pupil expenditures for instruction, supplies and materials, support services, and community services were eliminated from the model, due to their excessively strong relationships with total per pupil expenditures. Not surprisingly, better funded schools tend to have more money to spend on everything. So, the variables, INSTEXPS, SUPMEXPS, SUPTEXPS, and COMMEXPS were dropped from the data set.

The extremely high correlations among these four fiscal variables made it impossible to retain any of them, because it would not be meaningful to combine them through factor analysis. For this reason, data on categories of expenditures were dropped, leaving EXPTOTAL, total expenditures per pupil. Compared with the dropped data elements, EXPTOTAL also presents no problematic correlations with teacher-related variables.

TABLE 3-3
CORRELATION MATRIX FOR SCHOOL VARIABLES

Correlations	TPRATIO	TMASTERS	TAVGPAY	TAVGEXP	INSTEXPS	SUPMEXPS	SUPTEXPS	COMMEXPS	EXPTOTAL
TPRATIO	1.00								
TMASTERS	-.32**	1.00							
TAVGPAY	-.40**	.72**	1.00						
TAVGEXP	-.17*	.41**	.50**	1.00					
INSTEXPS	-.21**	.44**	.54**	.28**	1.00				
SUPMEXPS	-.20*	.38**	.46**	.24**	.99**	1.00			
SUPTEXPS	-.22**	.41**	.51**	.26**	1.00**	.99	1.00		
COMMEXPS	-.23**	.39**	.57**	.19*	.78**	.74	.77**	1.00	
EXPTOTAL	.57**	-.12	-.10	-.03	-.14	-.16	-.16*	-.14	1.00

Minimum pairwise N = 217

Significance levels * = .01 ** = .001

Legend

TPRATIO	Teacher-pupil ratio for school
TMASTERS	Percent of teachers in school with Master's degrees
TAVGPAY	Teacher's average salary for school
TAVGEXP	Teacher's average years of experience for school
INSTEXPS	Instructional expenditures per pupil for district
SUPMEXPS	Per pupil expenditures for supplies and materials by district
SUPTEXPS	Per pupil expenditures for support services by district
COMMEXPS	Per pupil expenditures for community services by district
EXPTOTAL	Total district expenditures per pupil

3.3 LIBRARY MEDIA VARIABLES

Four sets of library media variables are involved in this study. All of these variables were converted to per pupil form to control the effects of school size.

- Staff variables include the number of hours per typical week the library media center (LMC) is staffed by state-endorsed library media specialist(s) (LMSHOURS), and the cumulative number of weekly hours for all LMC staff (STAFFHRS).
- Collection variables include the number of books (BOOKS), videos (VIDEOS), software packages (SOFTWARE), audio-visual items (A-V), and periodicals (SERIALS) in the library media collection as well as the number of microcomputers under the LMC's jurisdiction (COMPUTER).
- Service variables include per typical week counts of book and non-print circulation transactions (BOOKCIRC and AVCIRC, respectively), instructional uses of microcomputers (PCUSE), materials received from any source outside the school building (ILLETC), individuals receiving library/information skills instruction (LISC), hours LMC staff spent identifying materials to support instructional units developed by teachers (IDHOURS), and hours LMC staff spent in planning instructional units with teachers (PLANHRS).
- Expenditures variables include totals of funds spent from all sources which were actually expended on LMC materials and equipment during the year (MATLSEXP and EQPTEXP, respectively).

3.3.1 FINDINGS

Table 3-4 reports the correlation matrix generated for these sets of variables. Only two problematically high correlations were identified:

- **LMCs with larger book collections tend also to have more periodical subscriptions.** The number of book volumes (BOOKS) and the number of periodical subscriptions (SERIALS) have a correlation coefficient of .63 which is statistically significant at the .001 level (hereafter $p < .001$).

TABLE 3-4
CORRELATION MATRIX FOR LIBRARY MEDIA VARIABLES

Correlations	LMSHOURS	STAFFHRS	BOOKS	VIDEOS	SOFTWARE	A-V	SERIALS	COMPUTER
LMSHOURS	1.00							
STAFFHRS	.34**	1.00						
BOOKS	.34**	.55**	1.00					
VIDEOS	.16*	.43**	.58**	1.00				
SOFTWARE	.03	.21*	.42**	.27**	1.00			
A-V	.23**	.10	.06	.10	.05	1.00		
SERIALS	.27**	.47**	.63**	.48**	.23**	.00	1.00	
COMPUTER	.08	.13	.16*	-.00	.03	.06	-.05	1.00
BOOKCIRC	.17*	.16*	.19*	-.00	.22**	.12	-.08	.11
AVCIRC	.19*	.34**	.30**	.26**	.09	.11	.07	.21*
PCUSE	.00	.09	-.03	.05	.20*	.05	-.11	.55**
ILLETC	.06	.32**	.41**	.19*	.21**	-.01	.27**	.14
LISC	.14	.02	.00	-.09	-.03	.22**	-.19*	.00
IDHOURS	.36**	.55**	.48**	.34**	.05	-.02	.27**	.14
PLANHRS	.15	.27**	.25**	.20*	.04	.08	.09	.12
MATLSEXP	.07	.51**	.38**	.34**	.13	-.07	.48**	.02
EQPTEXPS	-.05	.25**	.01	-.02	.00	-.10	.11	.08

TABLE 3-4 -- CONTINUED

Correlations	BOOKCIRC	AVCIRC	PCUSE	ILLETC	LISC	IDHOURS	PLANHRS	MATLSEXP	EQPTEXPS
BOOKCIRC	1.00								
AVCIRC	.33**	1.00							
PCUSE	.15	.08	1.00						
ILLETC	.21*	.41**	.06	1.00					
LISC	.46**	.16	.18	.03	1.00				
IDHOURS	.08	.57**	.00	.31**	.04	1.00			
PLANHRS	-.03	.29**	-.02	.14	.09	.53**	1.00		
MATLSEXP	.03	.25**	-.06	.20*	-.16	.38**	.18*	1.00	
EQPTEXP	.08	.03	.05	.05	-.07	.12	.04	.70**	1.00

Minimum pairwise N = 131

Significance levels * = .01 ** = .001

Legend

LMSHOURS	Media-endorsed staff hours per typical week
STAFFHRS	Total staff hours per typical week
BOOKS	Book volumes
VIDEOS	Video cassettes
SOFTWARE	Software packages
A-V	Audio-visual materials
SERIALS	Periodical subscriptions (duplicated count)
COMPUTER	Microcomputer/pupil ratio
BOOKCIRC	Book circulation
AVCIRC	Audio-visual circulation
PCUSE	Instructional uses of microcomputers
ILLETC	Outside materials use (interlibrary loans, rentals)
LISC	Information skills instruction contacts
IDHOURS	Hours per typical week staff spend identifying materials for instructional units developed by teachers
PLANHRS	Hours per typical week staff spend planning instructional units with teachers
MATLSEXP	LMC materials expenditures
EQPTEXPS	LMC equipment expenditures

Note: All library media variables are per pupil figures.

- **LMCs which have more to spend on materials tend to have more to spend on equipment.** Materials and equipment expenditures (MATLSEXP, EQPTEXPS) have a correlation coefficient of .70 ($p<.001$).

Correlations among other library media variables pose no problems in terms of redundancy or statistical "static." Nonetheless, these variables are simply too numerous to yield a model that can be readily interpreted. This problem will be addressed in the factor analysis stage. For now, let it suffice to identify several mid-range, but statistically significant, relationships among these variables:

- **LMCs which have more endorsed staff tend to have staff who spend more time identifying materials for instructional units developed by teachers and more time collaborating with teachers in developing such units.** The professional role of the library media specialist is reflected in the correlation between LMSHOURS and IDHOURS (.36) and, in turn, the correlation between IDHOURS and PLANHRS (.53).

- **Numbers of books, periodical subscriptions, software packages, and videos in LMC collections tend to rise and fall together.** The complementary relationships between library materials in different formats is indicated by correlation coefficients for BOOKS with VIDEOS (.58) and SOFTWARE (.42) as well as SERIALS (.58).

- **Numbers of LMC staff and numbers of items in LMC collections tend to rise and fall together.** The integral relationship between staff size and collection size is suggested by the correlation coefficients for STAFFHRS with BOOKS (.55), SERIALS (.47), VIDEOS (.43), and SOFTWARE (.42).

- **Use of LMC materials, particularly audio-visual materials, appears likely to increase as teachers begin to involve LMC staff in their instructional planning.** A correlation between AVCIRC and IDHOURS (.57) implies that materials use may be influenced to some degree by the library media specialist matching appropriate materials with curricula developed independently by teachers. Curiously, however, there is virtually no such relationship between IDHOURS and BOOKCIRC.

- **The well-known impact of periodical subscription prices on LMC materials expenditures is evident.** The correlation between SERIALS and MATLSEXP (.48) reflects the substantial impact of the high cost of periodicals on materials expenditures.

3.3.2 ACTIONS

On the basis of these findings, the following actions were taken:

- **An attempt will be made to combine numbers of books and periodical subscriptions into a single collection size factor.** A problematically high correlation between BOOKS and SERIALS (.63) recommends this pair of variables to the factor analysis stage.

- **Separate dollar figures reported on LMC spending for materials and equipment will be added together to form a single variable.** Because these two original variables are counted in the same units, dollars, a factor analysis solution for their problematically high correlation need not be sought.

These actions are necessary to eliminate statistical "static" from the model of academic achievement. Such "static" includes both redundant variables and those whose relationships are so strong as to distract attention from the focus of this study.

- **Efforts to combine LMC variables will be made solely to reduce their numbers.** There is no statistical need to combine any of these variables; but, their sheer numbers --as well as the more moderate, yet statistically significant and intuitively appealing, relationships they demonstrate-- may be reducible via factor analysis.

This action is necessary simply to reduce the number of LMC data elements to proportions that can be interpreted meaningfully.

3.4 TEST SCORES

The norm-referenced test scores which represent academic achievement, the variable being predicted in this study, are drawn from the Iowa Tests of Basic Skills, Forms G and H (ITBS), for grades one, two, four, five, and seven, and from the Tests of Achievement and Proficiency, Forms G and H (TAP), for tenth grade.

Three ITBS scores are involved for schools dealing with the lower grades:[10]

- Reading scores reflect how well students read all of the different types of materials they are likely to encounter in everyday reading. Items in this test cover facts, inferences, and generalizations at various levels of difficulty for the different grades.
- Language scores indicate how well students have mastered the basic skills common to standard written English: spelling, capitalization, punctuation, and usage and expression.
- Work-Study scores come closest to measuring the "information literacy" of these students. These scores represent their ability to locate, interpret, and use information. This test calls for students to use a table of contents, an index, a dictionary, an encyclopedia, and other such reference materials.

Three parallel TAP scores are involved for schools serving tenth grade:[11]

- Reading scores reflect how well students read, both for explicit facts and inferences, in a variety of genre and on many topics.
- Written Expression scores indicate students' command of basic grammar as well as sentence and paragraph structure and the organization and evaluation of ideas.
- Using Sources of Information scores come closest to measuring the "information literacy" of these students. Students must read, interpret, and use data from a variety of print and graphic formats.

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[10] *The 1991 Riverside Resource Catalog* (Chicago: Riverside, 1991), p. 4.

[11] *Ibid.*, p. 14.

3.4.1 FINDINGS

With remarkable consistency from grade to grade, students who are better readers also prove to be better users of language and of library media centers. Ranging between .75 and 1.00, virtually all of these correlation coefficients indicate substantial risks of redundancy and statistical "static." Simply put, for each grade, reading scores are so highly correlated with the other two test scores that the latter variables are unnecessary. Tables 3-5 through 3-10 report the correlation matrices generated for each trio of test scores by grade.

3.4.2 ACTIONS

ITBS and TAP Reading scores alone will represent academic achievement in the model to be tested. On the basis of these findings, scores for Language and Work-Study Skills as well as Written Expression and Using Sources of Information were dropped.

These dropped scores are so highly correlated with Reading scores that alternative models using them to represent academic achievement would be virtually identical to the one developed using Reading scores. Reading scores were chosen over the other types of scores because, for all grades, reading scores were more frequently reported than the others.

TABLE 3-5
CORRELATION MATRIX FOR FIRST GRADE ITBS SCORES

Correlations	READING	LANGUAGE	W-S SKILLS
READING	1.00		
LANGUAGE	.89**	1.00	
W-S SKILLS	.86**	.89**	1.00

Min. pairwise N = 43

TABLE 3-6
CORRELATION MATRIX FOR SECOND GRADE ITBS SCORES

Correlations	READING	LANGUAGE	W-S SKILLS
READING	1.00		
LANGUAGE	.88**	1.00	
W-S SKILLS	.88**	.86**	1.00

Min. pairwise N = 46

TABLE 3-7
CORRELATION MATRIX FOR FOURTH GRADE ITBS SCORES

Correlations	READING	LANGUAGE	W-S SKILLS
READING	1.00		
LANGUAGE	.88**	1.00	
W-S SKILLS	.92**	.94**	1.00

Min. pairwise N = 65

W-S = Work-Study
WRIT EXP = Written Expression
USI = Using Sources of Information

TABLE 3-8
CORRELATION MATRIX FOR FIFTH GRADE ITBS SCORES

Correlations	READING	LANGUAGE	W-S SKILLS
READING	1.00		
LANGUAGE	.91**	1.00	
W-S SKILLS	.89**	.84**	1.00

Min. pairwise N = 98

TABLE 3-9
CORRELATION MATRIX FOR SEVENTH GRADE ITBS SCORES

Correlations	READING	LANGUAGE	W-S SKILLS
READING	1.00		
LANGUAGE	.90**	1.00	
W-S SKILLS	.80**	.80**	1.00

Min. pairwise N = 29

TABLE 3-10
CORRELATION MATRIX FOR TENTH GRADE TAP SCORES

Correlations	READING	WRIT EXP	USI
READING	1.00		
WRIT EXP	.81**	1.00	
USI	.82**	.75**	1.00

Min. pairwise N = 24

Significance levels * = .01 ** = .001

3.5 SUMMARY

This chapter has presented the results of a series of correlation analyses which provide bases for eliminating redundant variables and suggest relationships among variables that might be combined. Community variables reflecting the ruralness and low socio-economic status of some school districts in 1980 were discarded, usually in favor of current building-level data. Related variables reflecting the at-risk status of communities were identified as candidates for combination into a single variable. Of the school variables, those sub-dividing total per pupil expenditures by type were discarded as redundant, while several characteristics of teachers were identified for possible combination. None of the library media variables was found to be problematic statistically; however, meaningful, though relatively weak, links among some of these items were identified for further examination. Their combination into a smaller number of variables will be considered strictly for the purpose of data reduction. Finally, test scores on language and library information skills (i.e., Work-Study Skills in ITBS, Using Sources of Information in TAP) were discarded as redundant, leaving reading scores to stand alone as the lone representative of the three types of test scores being predicted.

In the following chapter, factor analysis will be used to test the potential combinations of variables and to generate factor scores to replace any sets of variables which are combined.

CHAPTER 4

COMBINING RELATED PREDICTORS OF ACADEMIC ACHIEVEMENT

For community variables, a single factor encompassing at-risk conditions, such as poverty, minority status, low adult educational attainment, and large family size was anticipated. For school variables, two factors describing teacher characteristics (educational attainment, experience, workload) and school finance (teacher pay and per pupil expenditures) were sought. For library media variables, anticipated factors included staffing (media-endorsed and total staff hours, hours spent in various activities), materials (books, serials, videos), services (circulation, library instruction, computing), and funding (materials and equipment expenditures). Some of these factors emerged, others did not, and still other, unanticipated factors were discovered.

The following narrative and tables report the findings of these attempts at combining related predictors of academic achievement and the statistical factors resulting from them. Two types of statistics generated by these factor analyses are important. One important statistic is a factor loading. Similar to the correlation coefficients reported in Chapter 3, these figures indicate instead the direction and strength of relationship between each variable in a set and the factor generated from that set of variables by computer. Another important statistic in each analysis is the percent of variation explained. This figure indicates how much of the total variation in all included variables is explained by the factor. In analyzing these findings, factor loadings of at least .50 and variation explained of at least 50 percent were minimum criteria.

4.1 COMMUNITY VARIABLES

Four variables reflecting the community context of library media centers appear to be related. These four variables are:

- the percentage of district residents age 25 and over who graduated from high school (HSGRAD),
- average family size (FAMSIZE),
- the percentage of the school's students in selected racial/ethnic groups (MINORITY), and
- the percentage of the school's students who participate in the National School Lunch Program--a proxy measure of low socio-economic status (FREELNCH).

4.1.1 FINDINGS

The first attempt at combining these variables indicated that adult educational attainment, poverty, and minority status are interrelated; but, family size was excluded from that combination. In the initial matrix, the four community variables require a two factor solution. HSGRAD, FREELNCH, and MINORITY load together on the first factor, while FAMSIZE loads alone on a second factor. Statistics for these initial factors indicate that neither of these two factors meets the 50 percent variation explained criterion at 48.3 and 25.5 percent, respectively.

Tables 4-1 and 4-2 report the initial factor matrix for these four community variables and initial statistics for the factors generated.

TABLE 4-1
INITIAL FACTOR MATRIX FOR COMMUNITY VARIABLES

VARIABLE	FACTOR 1	FACTOR 2
HSGRAD	-.82	-.26
FREELNCH	.77	-.22
MINORITY	.74	-.36
FAMSIZE	-.08	.94

TABLE 4-2
INITIAL STATISTICS FOR COMMUNITY FACTORS

Variable	Communality	Factor	Eigenvalue	% Variance Explained	Cumulative Percent
FAMSIZE	.89	1	1.93	48.3	48.3
MINORITY	.68	2	1.02	25.5	73.8
FREELNCH	.64				
HSGRAD	.74				

On a second attempt, the combination of adult educational attainment, poverty, and minority status yielded a single factor reflecting at-risk conditions in the community. A second and final matrix including only MINORITY, FREELNCH, and HSGRAD was generated. These three variables load highly on a single factor to be called the At-risk Factor (ATRISK). This factor explains 61.5 percent of the variation in these three variables, thereby meeting the criterion. This factor reflects the strong interrelationships between minority status, poverty, and low educational attainment among adults in the community--a complex of conditions generally recognized as putting students at risk of school failure.

Tables 4-3 and 4-4 report the second and final factor matrix for the first three variables and final statistics for the factor generated.

TABLE 4-3
FINAL FACTOR MATRIX FOR COMMUNITY VARIABLES

VARIABLE	FACTOR 1
MINORITY	.80
FREELNCH	.80
HSGRAD	-.75

TABLE 4-4
FINAL STATISTICS FOR At-Risk FACTOR

Variable	Commu-nality	Factor	Eigen-value	% Variance Explained	Cumulative Percent
MINORITY	.65	1	1.85	61.5	61.5
FREELNCH	.64				
HSGRAD	.56				

4.1.2 ACTIONS

On the basis of these findings, the following actions were taken:

- **Three of the four community variables were combined in a factor reflecting at-risk conditions, specifically the inter-relationship of minority status, poverty, and low adult educational attainment.** Accordingly, the At-risk Factor (ATRISK) replaced MINORITY, FREELNCH, and HSGRAD for the balance of this study.

- **Because family size did not demonstrate expected relationships to other at-risk conditions, this variable will be omitted from the model to be tested.** Owing to the mix of single and two-parent families, average family size **(FAMSIZE)** proved not to be the indicator of the number of children per family it was originally envisioned to be. Intuitively, it was expected that children with fewer siblings have the advantage of less competition for parental assistance with homework. This intuition is balanced, however, by the expectation that children with two parents have a better chance of obtaining parental assistance than children of single parents. Average family size may reflect either set of circumstances, not just the number of children per family.

4.2 SCHOOL VARIABLES

Five variables reflect the school context of library media centers. Four of these five variables which relate directly to teachers are:

- the ratio of teachers to pupils (TPRATIO),
- the percentage of the school's teachers with Master's degrees (TMASTERS),
- average years of experience for a school's teachers (TAVGEXP), and
- the average salary for the school's teachers (TAVGPAY).

The fifth school variable is total per pupil expenditures for the school district (EXPTOTAL).

4.2.1 FINDINGS

The first attempt at combining the four teacher variables failed to yield the expected results: a teacher factor and an expenditures factor. Instead, it pointed to a distinction between the teacher-pupil ratio and the other teacher variables. The latter are at least somewhat under the control of teachers, while the former is usually a consequence of school funding.

In the initial factor matrix, these five variables require a two factor solution. TAVGPAY, TMASTERS, and TAVGEXP load together on the first factor, while EXPTOTAL and TPRATIO require a second factor. At 48.1 and 26.4 percent, respectively, neither of these factors meets the 50 percent variation explained criterion.

Tables 4-5 and 4-6 report the initial factor matrix for school variables and initial statistics for the factors generated.

TABLE 4-5
INITIAL FACTOR MATRIX FOR SCHOOL VARIABLES

VARIABLE	FACTOR 1	FACTOR 2
TAVGPAY	.88	-.19
TMASTERS	.84	-.17
TAVGEXP	.75	.04
EXPTOTAL	.05	.91
TPRATIO	-.28	.84

TABLE 4-6
INITIAL STATISTICS FOR SCHOOL FACTORS

Variable	Communality	Factor	Eigenvalue	% Variance Explained	Cumulative Percent
TPRATIO	.79	1	2.41	48.1	48.1
TAVGPAY	.81	2	1.32	26.4	74.6
TAVGEXP	.56				
TMASTERS	.73				
EXPTOTAL	.82				

On a second attempt, teachers' average pay, the percentage of teachers with Master's degrees, and teachers' average years of experience yielded a single factor reflecting characteristics of "career teachers." A second factor matrix including only TAVGPAY, TMASTERS, and TAVGEXP was generated. These three variables load highly on a single factor that will be called the Career Teacher Factor. This factor explains 69.9 percent of the variation among these three variables, thereby meeting the criterion. This factor reflects the strong inter-relationships between higher educational attainment, experience, and pay among teachers. Teachers who have Master's degrees and more years of experience tend to earn higher pay.

Tables 4-7 and 4-8 report the second and final factor matrix for the first three variables and final statistics for the factor generated.

TABLE 4-7
FINAL FACTOR MATRIX FOR SCHOOL VARIABLES

VARIABLE	FACTOR 1
TAVGPAY	.90
TMASTERS	.87
TAVGEXP	.73

TABLE 4-8
FINAL STATISTICS FOR CAREER TEACHER FACTOR

Variable	Commu-nality	Factor	Eigen-value	% Variance Explained	Cumulative Percent
TAVGPAY	.81	1	2.10	69.9	69.9
TAVGEXP	.53				
TMASTERS	.75				

4.2.2 ACTIONS

On the basis of these findings, the following actions were taken:

- **Teacher's average pay, the percentage of teachers with Master's degrees, and teacher's average years of experience were combined into a single factor characterizing "career teachers."** The Career Teacher Factor (CARTCHR) replaces TAVGPAY, TMASTERS, and TAVGEXP for the balance of this study.

- **A factor combining the teacher-pupil ratio and total expenditures per pupil was not deemed interpretable; so, these two variables will be retained separately.** While TPRATIO was expected to cluster with the variables which comprise CARTHCR as teacher characteristics, the findings reflect the fact that the teacher-pupil ratio is less a characteristic of teachers than of the school generally.

4.3 LIBRARY MEDIA VARIABLES

Eighteen variables describe library media center (LMCs). These variables include:

- numbers of materials by format (BOOKS, SERIALS, A-V, VIDEOS, SOFTWARE, ILLETC);
- the number of microcomputers under the LMC's jurisdiction (COMPUTER);
- numbers of media-endorsed and total staff hours per typical week (MEHOURS, STAFFHRS);
- numbers of staff hours spent per typical week playing different roles in curriculum development (IDHOURS, PLANHRS);
- numbers of service transactions (BOOKCIRC, AVCIRC, LISC--i.e., information skills instruction contacts--ILLCIRC, PCUSE); and
- expenditures on materials and equipment (MATLSEXP, EQPTEXPS).

All of these variables are expressed in per pupil ratios.

4.3.1 FINDINGS

Results of the first attempt to combine some of these variables suggest that there might be five meaningful factors: LMC Size, the Library Media Specialist Role, LMC Expenditures, LMC Use, and Computing.

In the initial matrix, the 18 library media variables require a six factor solution. BOOKS, SERIALS, VIDEOS, SOFTWARE, and STAFFHRS load together on the first factor. MEHOURS, IDHOURS, PLANHRS, and AVCIRC load together on the second factor. EQPTEXPS and MATLSEXP load together on the third factor. AVCIRC, BOOKCIRC, and LISC load together on the fourth factor. PCUSE and COMPUTER load together on the fifth factor. And, A-V, ILLCIRC, MEHOURS, and ILLETC load together on the sixth and final factor. Statistics for these initial factors indicate that none of these factors meets the 50 percent variation explained criterion, ranging from a high of 24.0 to a low of 6.5 percent.

Tables 4-9 and 4-10 report the initial factor matrix for these 18 library media variables and initial statistics for the factors generated.

Ultimately, a factor reflecting the size of an LMC's staff and collection combined four variables: total LMC staff hours and numbers of books, periodical subscriptions, and videos in the LMC collection. Three factor analyses were necessary to establish this factor. In the process, three variables which did not contribute to this factor were discarded. The numbers of audio-visual materials, software packages, and outside materials proved unnecessary to the LMC Size Factor.

TABLE 4-9
FACTOR MATRIX FOR LIBRARY MEDIA VARIABLES

VARIABLE	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
BOOKS	.83	.30	.04	.11	.02	.04
SERIALS	.77	.10	.20	-.20	-.16	.09
VIDEOS	.71	.22	-.00	-.11	.01	.07
SOFTWARE	.64	-.26	-.02	.25	.20	-.10
STAFFHRS	.55	.43	.34	.09	.07	.16
IDHOURS	.27	.83	.16	.05	.02	-.01
PLANHRS	.03	.73	.01	-.08	.05	.06
AVCIRC	.15	.64	.06	.42	.10	-.12
EQPTEXPS	-.05	.01	.92	.03	.07	-.02
MATLSEXP	.37	.22	.82	-.05	-.06	-.02
BOOKCIRC	.09	-.01	.09	.86	.08	.08
LISC	-.18	.10	-.12	.70	.02	.28
PCUSE	.03	-.08	.00	.13	.88	.06
COMPUTER	.00	.21	.03	-.01	.86	-.01
A-V	.09	.08	-.22	.17	.06	.58
ILLCIRC	-.01	.08	-.21	-.09	-.02	-.54
MEHOURS	.27	.38	-.11	.10	-.04	.50
ILLETC	.40	.31	.00	.36	.06	-.50

TABLE 4-10
STATISTICS FOR LIBRARY MEDIA FACTORS

Variable	Communality	Factor	Eigenvalue	% Variance Explained	Cumulative Percent
BOOKS	.79	1	4.31	24.0	24.0
SERIALS	.72	2	2.11	11.7	35.7
VIDEOS	.57	3	1.58	8.8	44.4
SOFTWARE	.59	4	1.43	7.9	52.4
STAFFHRS	.64	5	1.31	7.3	59.6
IDHOURS	.78	6	1.17	6.5	66.2
PLANHRS	.54				
AVCIRC	.64				
EQPTEXPS	.86				
MATLSEXP	.87				
BOOKCIRC	.77				
LISC	.63				
PCUSE	.79				
COMPUTER	.78				
A-V	.43				
ILLCIRC	.35				
MEHOURS	.50				
ILLETC	.64				

The first attempt at an LMC Size Factor generated two factors, one of which isolated audio-visual materials and neither of which met the 50 percent variance explained criterion. BOOKS, SERIALS, STAFFHRS, VIDEOS, ILLETC, and SOFTWARE load together highly on one factor, while A-V loads highly alone on a second factor. Initial statistics for these two factors indicate that neither meets the 50 percent variance explained criterion. Tables 4-11 and 4-12 report the initial factor matrix for seven variables describing the size of the library media center and initial statistics for factors generated.

TABLE 4-11
INITIAL FACTOR MATRIX FOR LMCSIZE VARIABLES

VARIABLE	FACTOR 1	FACTOR 2
BOOKS	.88	.02
SERIALS	.77	-.04
STAFFHRS	.72	.11
VIDEOS	.72	.19
ILLETC	.54	-.24
SOFTWARE	.51	.01
A-V	.05	.96

TABLE 4-12
INITIAL STATISTICS FOR LMCSIZE FACTORS

Variable	Communality	Factor	Eigenvalue	% Variance Explained	Cumulative Percent
STAFFHRS	.54	1	2.98	42.5	42.5
BOOKS	.78	2	1.02	14.6	57.1
SERIALS	.59				
VIDEOS	.55				
A-V	.92				
SOFTWARE	.26				
ILLETC	.35				

The second attempt at an LMC Size Factor generated a single factor; but, two variables--software packages and outside materials--weakened it. BOOKS, SERIALS, STAFFHRS, and VIDEOS have factor loadings between .73 and .88; then, there is a substantial drop for ILLETC and SOFTWARE to .53 and .51, respectively. Initial statistics for this factor indicate that it falls just short of the percent of variance explained criterion. More problematic are the low communalities for ILLETC and SOFTWARE--.28 and .26, respectively--which indicate the low proportion of their variation which they share with the other variables. Communalities for STAFFHRS, BOOKS, SERIALS, and VIDEOS range between .53 and .78. Tables 4-13 and 4-14 report a second factor matrix for six variables describing the size of the library media center and initial statistics for this factor.

TABLE 4-13
SECOND FACTOR MATRIX FOR LMCSIZE VARIABLES

VARIABLE	FACTOR 1
BOOKS	.88
SERIALS	.77
STAFFHRS	.73
VIDEOS	.73
ILLETC	.53
SOFTWARE	.51

TABLE 4-14
SECOND STATISTICS FOR LMCSIZE FACTOR

Variable	Communality	Factor	Eigenvalue	% Variance Explained	Cumulative Percent
STAFFHRS	.53	1	2.97	49.5	49.5
BOOKS	.78				
SERIALS	.59				
VIDEOS	.53				
SOFTWARE	.26				
ILLETC	.28				

The LMC Size Factor confirms that LMC staff size and LMC collection size rise and fall together. The third, successful attempt to create this factor combined total staff hours with numbers of books, periodical subscriptions, and videos. BOOKS, SERIALS, VIDEOS, and STAFFHRS have factor loadings between .76 and .87, and, the LMC Size Factor explains 64.5 percent of the variation in these variables. Notably, it was a surprise that STAFFHRS--total staff hours per typical week --loaded highly on the same factor with BOOKS, SERIALS, and VIDEOS--numbers of materials per pupil in those formats. Two separate factors for staff and materials variables were anticipated. In hindsight, however, it makes sense that LMCs with larger collections tend also to have more staff. This LMC Size Factor will hereafter be referred to as LMCSIZE. Tables 4-15 and 4-16 report a second and final factor matrix for four variables describing the size of the library media center and final statistics for that factor.

TABLE 4-15
FINAL FACTOR MATRIX FOR LMCSIZE VARIABLES

VARIABLE	FACTOR 1
BOOKS	.87
SERIALS	.81
VIDEOS	.77
STAFFHRS	.76

TABLE 4-16
FINAL STATISTICS FOR LMCSIZE FACTOR

Variable	Communality	Factor	Eigenvalue	% Variance Explained	Cumulative Percent
STAFFHRS	.57	1	2.58	64.5	64.5
BOOKS	.76				
SERIALS	.66				
VIDEOS	.59				

The Library Media Specialist Role Factor (LMSROLE) confirms that library media professionals play an important role in the instructional process. This LMS Role Factor combines three counts of hours per week: media-endorsed staff hours and hours spent by LMC staff both identifying materials for teacher-planned instructional units and collaborating with teachers in planning such units. MEHOURS, IDHOURS, and PLANHRS have factor loadings between .60 and .87, and, together, explain 57.1 percent of the variation in the professional library media specialist role. Notably, while the initial factor analysis grouped MEHOURS, IDHOURS, and PLANHRS with AVCIRC, the latter variable also loaded highly on a later factor where it has a better intuitive fit. For that reason, AVCIRC is excluded from this analysis. Tables 4-17 and 4-18 report the factor matrix and statistics for three variables describing the role of the professional school library media specialist.

TABLE 4-17
FACTOR MATRIX FOR LMSROLE VARIABLES

VARIABLE	FACTOR 1
IDHOURS	.87
PLANHRS	.77
MEHOURS	.60

TABLE 4-18
STATISTICS FOR LMSROLE FACTOR

Variable	Communality	Factor	Eigenvalue	% Variance Explained	Cumulative Percent
MEHOURS	.36	1	1.71	57.1	57.1
IDHOURS	.76				
PLANHRS	.59				

The LMC Use Factor (LMCUSE) confirms that information skills instruction affects use of print and non-print materials. BOOKCIRC, AVCIRC, and LISC have factor loadings between .62 and .84, and, together, explain 55.0 percent of the variation in LMC use. This LMC Use Factor reflects the important relationship between information skills instruction contacts and use of both print and non-print collections. Tables 4-19 and 4-20 report the factor matrix and statistics for three variables describing the use of school library media centers.

TABLE 4-19
FACTOR MATRIX FOR LMCUSE VARIABLES

VARIABLE	FACTOR 1
BOOKCIRC	.84
LISC	.74
AVCIRC	.62

TABLE 4-20
STATISTICS FOR LMCUSE FACTOR

Variable	Communality	Factor	Eigenvalue	% Variance Explained	Cumulative Percent
BOOKCIRC	.71	1	1.65	55.0	55.0
AVCIRC	.38				
LISC	.56				

The LMC Computing Factor (COMPUTING) confirms the importance of students having access to microcomputers to their learning to use them. COMPUTER and PCUSE share a factor loading of .88, and the Computing Factor explains 77.3 percent of variation in these variables. It should be noted, however, that this factor measures the presence and use of microcomputers only if they are either located in or under the jurisdiction of the LMC. Computers housed and used elsewhere in the school are not included. Tables 4-21 and 4-22 report the factor matrix and statistics for two variables describing computing in library media centers.

TABLE 4-21
FACTOR MATRIX FOR COMPUTING VARIABLES

VARIABLE	FACTOR 1
COMPUTER	.88
PCUSE	.88

TABLE 4-22
STATISTICS FOR COMPUTING FACTOR

Variable	Commu-nality	Factor	Eigen-value	% Variance Explained	Cumulative Percent
COMPUTER	.77	1	1.54	77.3	77.3
PCUSE	.77				

4.3.2 ACTIONS

On the basis of these findings, the following actions were taken:

- **The number of total staff hours per week and numbers of books, periodical subscriptions, and videos in the collection were combined in the LMC Size Factor.** Therefore, LMCSIZE replaces STAFFHRS, BOOKS, SERIALS, and VIDEOS. SOFTWARE, ILLETC, and A-V were dropped from this factor on statistical grounds in the pursuit of a single strong factor reflecting LMC size.

- **The Library Media Specialist Role Factor combines the number of media-endorsed staff hours per week and the numbers of hours staff spend identifying materials for teacher-planned instructional units and collaborating with teachers in planning instructional units.** Thus, LMSROLE replaces MEHOURS, IDHOURS, PLANHRS.

- **The number of individual contacts by staff to provide information skills instruction as well as print and non-print circulation figures were combined in the LMC Use Factor.** Thus, LMCUSE replaces BOOKCIRC, AVCIRC, and LISC.

- **The LMC Computing Factor combines the number of microcomputers in or under the jurisdiction of the LMC with the number of instructional uses of those microcomputers per week.** Thus, COMPUTING replaces COMPUTER and PCUSE.

- **Materials and equipment expenditures were simply summed to create a new variable (LMCEXPS) for library media center expenditures.** Because MATLSEXP and EQPTEXPS are on the same scale--dollars--it was not necessary to generate a factor to combine them.

4.4 SUMMARY

To recapitulate, this chapter has described a series of factor analyses which have helped to achieve a substantial reduction in data to be included in the model of student achievement. The four community variables which survived correlation analysis were reduced to three and combined into an At-risk (ATRISK) Factor. The five school variables were reduced to three, including a single factor which combines three variables relating to career teachers (CARTHCR), and Teacher-Pupil Ratio and Total Expenditures per Pupil. And, finally, five new library media variables replace the original 18. The substantial reduction in data thus achieved will make the model of student achievement easier to interpret and, therefore, more meaningful and useful. With the data reduction phase of this research completed, the next step is to conduct a path analysis of these data via stepwise multiple regression techniques. The following chapter reports on that analysis.

CHAPTER 5

TESTING THE MODEL: DIRECT PREDICTORS OF ACADEMIC ACHIEVEMENT

The previous chapter described a series of factor analyses which resulted in a substantial reduction of data. As a result of these analyses, several sets of variables were combined into factor scores, other variables measured on the same scale were simply added together, and selected variables that did not demonstrate anticipated relationships to other variables were discarded. This fifth chapter presents the results of a path analysis achieved via stepwise multiple regression techniques. The purpose of this is to identify which of several community, school, and library media variables predict academic achievement and to assess their relative importance. (Chapter 2 explains these techniques as well as the protocols of path analysis.)

The community context of school library media centers (LMCs) is represented in this analysis by an At-risk Factor which reflects social and economic conditions likely to jeopardize a student's readiness to learn. The school context of LMCs is represented by three variables, including the Teacher-Pupil Ratio, Total Expenditures per Pupil, and the Career Teacher Factor. Library media center variables include four factor scores--Library Media Center (LMC) Size, the Library Media Specialist (LMS) Role, LMC Use, and Computing--as well as a composite variable for Library Media Expenditures. Academic achievement itself is represented by reading scores on the Iowa Tests of Basic Skills (ITBS) and Tests of Achievement and Proficiency (TAP). Certainly, the list of variables being considered as potential predictors of test performance is not exhaustive. They are,

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however, the only such variables for which appropriate data were available for the schools under study.

The following narrative and tables report the findings of two series of regression analyses by grade. The first series identifies predictors of test scores on a grade by grade basis, such that the number of predictors and particular predictors identified for a given grade may differ from those for other grades. The second series of regression analyses focuses on those predictors of test scores which demonstrate the most consistent relationships with test performance across grades. In that second series of analyses, any variables which demonstrate predictive power on an isolated basis (i.e., for one or two grades) will be discarded as statistical static.

Notably, the Statistical Package for the Social Sciences (SPSS) applies two criteria of statistical significance in assessing the value of a variable in this type of analysis. Significance, in a statistical sense, refers to the unlikeliness that an observed relationship could be attributed to sampling error alone. To be included in the regression equation, a variable must pass the test of significance at the .05 level. In other words, for a variable to be considered of genuine analytical value, there must be fewer than five chances in a hundred that its impact can be written off to an unrepresentative sample. Further, as additional variables are added, a variable may be excluded from the equation when its significance exceeds the .10 level. If the odds are more than one in ten that a variable's impact is spurious, it is considered too dubious to be taken seriously from a statistical point of view. The necessity of using a highly self-selected sample for this study makes the application of these criteria extremely important. When these tests are met, there is some assurance that the relationships discovered for this sample reflect reality.

5.1 INITIAL REGRESSION ANALYSIS

Because norm-referenced test scores cannot be combined across grades, six separate regression analyses for grades one, two, four, five, seven, and ten were performed. The dependent variable--the one being predicted--was ITBS or TAP reading scores. In each analysis, the same set of independent variables or potential predictors was offered. These include:

- the At-risk Factor,
- the Teacher-Pupil Ratio,
- the Career Teacher Factor,
- Total Expenditures per Pupil,
- the LMC Size Factor,
- the LMS Role Factor,
- the LMC Use Factor,
- the LMC Computing Factor, and
- LMC Expenditures.

The tables in this chapter and the following one report five types of statistics resulting from each regression analysis:

- multiple R, a statistic indicating the strength of a set of predictors, which is cumulated as each variable's explanatory power is added;
- R squared, the square of the previous statistic, which indicates the cumulative percentage of variation in test scores explained as each variable is added;
- R square change, which indicates the additional percentage of test score variation explained as each variable is added;
- beta, the path coefficient, which reflects the direction of a variable's relationship to test scores as well as its explanatory power when the effects of all other variables in the equation are taken into account simultaneously; and
- the significance of T, a test of statistical significance which identifies the probability that each variable's predictive power is the spurious result of an unrepresentative sample.

The first four types of statistics can range from .00 to 1.00, but only R squared and R square change may be interpreted literally as percentages of variation explained. Three standard levels of statistical significance are reported: <.05, <.01, and <.001. For example, <.05, should be interpreted to mean that there are fewer than five chances in 100 that the results obtained for this sample of Colorado schools do not apply for all Colorado schools.

5.1.1 FIRST GRADE FINDINGS

Preliminary findings for first grade indicate that at-risk conditions, LMC expenditures, total per pupil expenditures, and LMC size predict academic achievement.

- **As at-risk conditions decrease, test scores increase.** Predictably, there is a negative relationship between the At-risk Factor and first grade ITBS reading scores.
- **As expenditures on materials and equipment for school library media centers increase, first grade scores increase.** There is a positive relationship between LMC Expenditures and first grade ITBS reading scores.
- **As total per pupil expenditures decrease, first grade scores increase.** Surprisingly, there is a negative relationship between Total Expenditures per Pupil and first grade ITBS reading scores. Notably, this counter-intuitive finding follows--and therefore takes account of--the preceding positive relationship between LMC expenditures and test scores. This relationship might reflect the value of spending on library media centers as opposed to other school programs. It may also be a statistical artifact, following in the wake of the finding about LMC expenditures. However, drawing either conclusion would be premature based on this single, initial analysis.
- **As the size of a school library media center's staff and collection increase, first grade scores increase.** There is a positive relationship between LMC Size and first grade ITBS reading scores.

The initial regression analysis of first grade ITBS reading scores resulted in a four variable explanation of 47 percent of the variation in such scores. (See Table 5-1.) In order of importance, the four variables are: the At-risk Factor, LMC Expenditures, Total Expenditures per Pupil, and the LMC Size Factor. Their levels of statistical significance range from <.01 to <.001.

TABLE 5-1
INITIAL REGRESSION ANALYSIS OF FIRST GRADE ITBS READING SCORES

Statistic Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
ATRISK	.50	.25	.25	-.46	<.001
LMCEXP	.57	.33	.07	.29	<.05
EXPTOTAL	.63	.39	.07	-.40	<.01
LMCSIZE	.68	.47	.07	.32	<.05

5.1.2 SECOND GRADE FINDINGS

Preliminary findings for second grade indicate that at-risk conditions, LMC size, teacher-pupil ratio, computing, and LMC expenditures predict academic achievement.

- **As at-risk conditions decrease, second grade scores increase.** As for the first grade, there is a negative relationship between the At-risk Factor and second grade ITBS reading scores.

- **As the size of a school library media center's staff and collection increase, second grade scores increase.** As for the first grade, there is a positive relationship between the LMC Size Factor and second grade ITBS reading scores.

- **As the number of teachers relative to pupils decreases, second grade scores increase.** Surprisingly, there is a negative relationship between Teacher-Pupil Ratio and second grade ITBS reading scores. Like the earlier counter-intuitive finding, this one follows a positive relationship between LMC size (including the LMC staff/pupil ratio) and test scores. Similar to the earlier finding, this one may reflect the merits of staffing LMCs as opposed to staffing other programs. However, it may simply be a statistical artifact following in the wake of the preceding finding. As before, this first appearance of an unexpected relationship bears watching as the analysis unfolds.

- **As access to and use of microcomputers in or under the jurisdiction of LMCs decrease, second grade scores increase.** There is a negative relationship between the LMC Computing Factor and second grade ITBS reading scores. This counter-intuitive finding calls into question the assumption that computers are likely to be located and used and in the LMC. Perhaps, as the number of computers grows, school decision-makers tend to concentrate them in a separate computing center or distribute them among classrooms.

- **As expenditures on materials and equipment for school library media centers increase, second grade scores increase.** There is a positive relationship between LMC Expenditures and second grade ITBS reading scores.

The initial regression analysis of second grade ITBS reading scores resulted in a five variable explanation of 62 percent of the variation in such scores. (See Table 5-2.) In order of importance, the four variables are: the At-risk Factor, the LMC Size Factor, Teacher-Pupil Ratio, the LMC Computing Factor, and LMC Expenditures. Their levels of statistical significance range from <.01 to <.001.

TABLE 5-2
INITIAL REGRESSION ANALYSIS OF
SECOND GRADE ITBS READING SCORES

Statistic Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
ATRISK	.44	.19	.19	-.44	<.001
LMCSIZE	.59	.35	.15	.69	<.001
TPRATIO	.68	.46	.12	-.58	<.001
COMPUTING	.76	.57	.11	-.35	<.01
LMCEXP	.79	.62	.05	.24	<.05

5.1.3 FOURTH GRADE FINDINGS

Preliminary findings for fourth grade indicate that LMC size and at-risk conditions predict academic achievement.

- **As the size of an LMC's staff and collection increases, fourth grade scores increase.** As for first and second grade, there is a positive relationship between LMC Size and fourth grade ITBS reading scores.
- **As at-risk conditions decrease, fourth grade scores increase.** As for first and second grade, there is a negative relationship between the At-risk Factor and fourth grade ITBS reading scores.

The initial regression analysis of fourth grade ITBS reading scores resulted in a two variable explanation of 23 percent of the variation in such scores. (See Table 5-3.) In order of importance, the two variables are the LMC Size Factor and the At-risk Factor. Both achieved the <.01 level of statistical significance.

TABLE 5-3
INITIAL REGRESSION ANALYSIS OF FOURTH GRADE ITBS READING SCORES

Statistic Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
LMCSIZE	.34	.12	.12	.35	<.01
ATRISK	.48	.23	.11	-.33	<.01

5.1.4 FIFTH GRADE FINDINGS

Preliminary findings for fifth grade indicate that at-risk conditions, LMC size, and total per pupil expenditures predict academic achievement.

- **As at-risk conditions decrease, fifth grade scores increase.** As for earlier grades, there is a negative relationship between the At-risk Factor and fifth grade ITBS reading scores.

- **As the size of an LMC's staff and collection increases, fifth grade scores increase.** Also confirming earlier results, there is a positive relationship between LMC Size and fifth grade ITBS reading scores.

- **As total per pupil expenditures decrease, fifth grade scores increase.** In a recurrence of an earlier, unexpected finding, there is a negative relationship between Total Expenditures per Pupil and fifth grade ITBS reading scores. Before, this finding followed a positive relationship between LMC expenditures and test scores. In that case, the finding may have represented the relative value of spending on library media centers rather than other programs. It is equally likely, however, that it was a statistical artifact, following in the wake of the finding regarding LMC expenditures. In this case, LMC expenditures do not enter the equation. Perhaps LMC expenditures are related to LMC size strongly enough that the latter factor is "standing in" for it in these results.

The initial regression analysis of fifth grade ITBS reading scores resulted in a three variable explanation of 30 percent of the variation in such scores. (See Table 5-4.) In order of importance, the three variables are: the At-risk Factor, LMC Size, and Total Expenditures per Pupil. All three achieved the <.001 level of statistical significance.

TABLE 5-4
INITIAL REGRESSION ANALYSIS OF
FIFTH GRADE ITBS READING SCORES

Statistic Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
ATRISK	.36	.13	.13	-.38	<.001
LMCSIZE	.47	.22	.09	.45	<.001
EXPTOTAL	.55	.30	.08	-.33	<.001

5.1.5 SEVENTH GRADE FINDINGS

Preliminary findings for seventh grade indicate that LMC expenditures predict academic achievement.

- **As expenditures on library media materials and equipment increase, seventh grade scores increase.** There is a positive relationship between LMC Expenditures and seventh grade ITBS reading scores.

The initial regression analysis of seventh grade ITBS reading scores resulted in a single variable explanation of 22 percent of the variation in such scores. (See Table 5-5.) In its first re-appearance since the first grade analysis, LMC expenditures was that lone variable, achieving the <.05 level of statistical significance.

TABLE 5-5
INITIAL REGRESSION ANALYSIS OF
SEVENTH GRADE ITBS READING SCORES

Statistic Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
LMCEXP	.46	.22	.22	.47	<.05

5.1.6 TENTH GRADE FINDINGS

Preliminary findings for tenth grade indicate that at-risk conditions predict academic achievement.

- **As at-risk conditions decrease, tenth grade scores increase.** There is a negative relationship between the At-risk Factor and tenth grade TAP reading scores.

The initial regression analysis of tenth grade TAP reading scores resulted in another single variable explanation of 51 percent of the variation in such scores. (See Table 5-6.) In its strongest appearance of all, this variable was the At-risk Factor, achieving the <.01 level of statistical significance.

TABLE 5-6
INITIAL REGRESSION ANALYSIS OF
TENTH GRADE TAP READING SCORES

Statistic / Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
ATRISK	.71	.51	.51	-.71	<.01

5.1.7 ACTIONS

Two factors are recognized as consistent predictors of academic achievement: at-risk conditions and LMC size. Of the nine variables considered in the initial regression analysis, two demonstrated persistent, strong relationships with test scores: the At-risk and LMC Size Factors. Table 5-7 summarizes their preliminary path (beta) coefficients with test scores by grade.

Path (or beta) coefficients are reported in this summary, because they indicate the direction and relative importance of each predictor's relationship to test performance while controlling for the effects of the remaining predictors. Be aware, however, that path coefficients do not reflect percentages of explained variation; and, therefore, cannot be added together meaningfully. (Statistics for R Squared and R Square Change in earlier tables should be consulted to determine how much test score variation is explained by a particular set of predictors.)

TABLE 5-7
SUMMARY OF PRELIMINARY PATH (BETA) COEFFICIENTS FOR At-risk & LMC SIZE FACTORS WITH TEST SCORES BY GRADE

Variable Grade	Test Score Predictor	
	At-risk Factor	LMC Size Factor
1st	-.46	.32
2nd	-.44	.69
4th	-.33	.35
5th	-.38	.45
7th	-----	-----
10th	-.71	-----

Four other variables demonstrated relationships with test scores with varying frequency. These include: LMC Expenditures, Total Expenditures per Pupil, Teacher-Pupil Ratio, and LMC Computing.

- **Although a borderline case--predicting test scores for half of the grades under study--LMC Expenditures will be dropped for the second and final regression analysis.** The LMC Expenditures variable was a predictor of test scores for grades one, two, and seven. For first and second grades, it joined LMC Size as a test score predictor; but, for seventh grade, it was the lone predictor of test scores yielded by the analysis. For first grade, it also accompanies Total Expenditures per Pupil, while, for second grade, it is the last of the largest set of test score predictors, two of which (Teacher-Pupil Ratio and Computing) arise nowhere else in this initial analysis. These particular appearances suggest that LMC Expenditures is related to test scores; but, perhaps more indirectly than directly.

- **Total Per Pupil Expenditures will be dropped from the next analysis, because it demonstrates a direct relationship to test scores for only two of the six grades under study and because the context of those appearances (e.g., following LMC Expenditures) suggests that it may be a statistical artifact.** Alone, these two instances are deemed insufficient to justify the alternative interpretation that they imply a bias for library media expenditures over other school expenditures as test score predictors. Such an interpretation would have to be based on a more in-depth analysis of more detailed fiscal data on other school programs as well as library media centers. Owing to its intuitive appeal as a potential indirect predictor of test scores, this variable will be reintroduced at that stage of the analysis.

- **Teacher-Pupil Ratio will also be dropped from the next analysis, because it demonstrates a direct relationship to test scores only for second grade.** Like Total Expenditures per Pupil, the appearance of this variable--in this case, following LMC Size (which includes the LMC staff/pupil ratio)--suggests either a statistical artifact or another relationship requiring more precise study than is possible here. Like its two predecessors, this variable will be reintroduced when indirect links to library media centers and test scores are being considered.

- **The LMC Computing Factor will be dropped from this study altogether, because its lone appearance as a second grade test score predictor suggests that use of computers in schools extends too far beyond LMCs for this factor to be meaningful.** Owing to the questionable validity of this factor as a measure of computer access and use in schools, it will not be reintroduced later.

5.2 FINAL REGRESSION ANALYSIS

The At-risk and LMC Size Factors were the only two variables which predicted test scores for the majority of grades under study. For this reason, they alone were reintroduced in a second and final regression analysis of test scores by grade. This decision proceeds from the assumption that variables which predicted test scores for only one or two grades in the preliminary analysis were demonstrating statistical artifacts or spurious relationships with other unknown variables.

5.2.1 FIRST GRADE FINDINGS

Final findings for first grade indicate that both at-risk conditions and LMC size predict academic achievement.

- **As at-risk conditions decrease, first grade scores increase.** The At-risk Factor is related negatively to first grade test scores.
- **As the size of an LMC's staff and collection increase, first grade scores increase.** The LMC Size Factor is related positively to first grade test scores. LMC size adds only five percent to the 25 percent explanation of test score variation offered by at-risk conditions.

This dramatic difference in explanatory power indicates that, while library media programs can have a substantial effect on early test scores, at-risk conditions exert a much stronger effect as children begin school.

The final regression analysis of first grade ITBS reading scores with the At-risk and LMC Size Factors explained 31 percent of the variation in such scores. (See Table 5-8.) The At-risk Factor is statistically significant at the <.001 level; and, the LMC Size Factor, at the <.05 level.

TABLE 5-8
FINAL REGRESSION ANALYSIS OF
FIRST GRADE ITBS READING SCORES

Statistic / Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
ATRISK	.50	.25	.25	-.51	<.001
LMCSIZE	.55	.31	.05	.23	<.05

5.2.2 SECOND GRADE FINDINGS

Final findings for second grade indicate that both at-risk conditions and LMC size predict academic achievement.

- **As at-risk conditions decrease, second grade scores increase.** The At-risk Factor is related negatively to second grade test scores.
- **As the size of an LMC's staff and collection increase, second grade scores increase.** The LMC Size Factor is related positively to second grade test scores.

By second grade, the gap between the effects of at-risk conditions and LMC size is reduced dramatically. For first grade, LMC size added only 5 percent to the 25 percent explanation of test scores by at-risk conditions. For second grade, LMC size adds 15 percent to the 19 percent explanation of test scores by at-risk conditions. These findings suggest that, as children progress in their school careers, the importance of at-risk conditions is reduced, while the importance of school programs, such as library media centers, is increased.

The final regression analysis of second grade ITBS reading scores with the At-risk and LMC Size Factors explained 35 percent of the variation in such scores. (See Table 5-9.) The At-risk Factor is statistically significant at the <.001 level; and, the LMC Size Factor, at the <.01 level.

TABLE 5-9
FINAL REGRESSION ANALYSIS OF SECOND GRADE ITBS READING SCORES

Statistic Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
ATRISK	.44	.19	.19	-.45	<.001
LMCSIZE	.59	.35	.15	.39	<.01

5.2.3 FOURTH GRADE FINDINGS

Final findings for fourth grade indicate that both LMC size and at-risk conditions predict academic achievement.

- **As the size of an LMC's staff and collection increase, fourth grade scores increase.** The LMC Size Factor is related positively to fourth grade test scores.
- **As at-risk conditions decrease, fourth grade scores increase.** The At-risk Factor is related negatively to fourth grade test scores.

For this grade, LMC size weighs in with as great an effect as at-risk conditions (12 and 11 percent, respectively) as well as an equal level of statistical significance. These findings reinforce the notion that the influence of library media centers on test scores may grow as pupils progress through school, serving as a potential counterbalance to at-risk conditions.

The final regression analysis of fourth grade ITBS reading scores with the LMC Size and At-risk Factors explained 23 percent of the variation in such scores. (See Table 5-10.) Both factors are statistically significant at the <.01 level.

TABLE 5-10
FINAL REGRESSION ANALYSIS OF
FOURTH GRADE ITBS READING SCORES

Statistic Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
LMCSIZE	.34	.12	.12	.35	<.01
ATRISK	.48	.23	.11	-.33	<.01

5.2.4 FIFTH GRADE FINDINGS

Final findings for fifth grade indicate that both at-risk conditions and LMC size predict academic achievement.

- **As at-risk conditions decrease, fifth grade scores increase.** The At-risk Factor is related negatively to fifth grade test scores.

- **As the size of an LMC's staff and collection increase, fifth grade scores increase.** The LMC Size Factor is related positively to fifth grade test scores.

For this grade, at-risk conditions re-assert themselves as the stronger of the two predictors of test scores; but, LMC size comes in a very strong second.

The final regression analysis of fifth grade ITBS reading scores with the At-risk and LMC Size Factors explained 22 percent of the variation in such scores. (See Table 5-11.) The At-risk Factor is statistically significant at the <.001 level; and, the LMC Size Factor, at the <.01 level.

TABLE 5-11
FINAL REGRESSION ANALYSIS OF
FIFTH GRADE ITBS READING SCORES

Statistic Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
ATRISK	.36	.13	.13	-.37	<.001
LMCSIZE	.47	.22	.09	.30	<.01

5.2.5 SEVENTH GRADE FINDINGS

Final findings for seventh grade indicate that both LMC size and at-risk conditions predict academic achievement.

- **As the size of an LMC's staff and collection increase, seventh grade scores increase.** The LMC Size Factor is related positively to seventh grade test scores.

- **As at-risk conditions decrease, seventh grade scores increase.** The At-risk Factor is related negatively to seventh grade test scores.

Notably, for this grade, LMC size weighs in with a greater effect on test scores and greater statistical significance than at-risk conditions. This finding may indicate the potential influence of library media centers on test scores as students become more independent and in-depth users of print and non-print materials.

The final regression analysis of seventh grade ITBS reading scores with the LMC Size and At-risk Factors explained 37 percent of the variation in such scores. (See Table 5-12.) The LMC Size Factor is statistically significant at the <.01 level; and, the At-risk Factor, at the <.05 level.

TABLE 5-12
FINAL REGRESSION ANALYSIS OF SEVENTH GRADE ITBS READING SCORES

Statistic Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
LMCSIZE	.46	.21	.21	.47	<.01
ATRISK	.61	.37	.16	-.40	<.05

5.2.6 TENTH GRADE FINDINGS

Final findings for the tenth grade indicate that both at-risk conditions and LMC size predict academic achievement.

- **As at-risk conditions decrease, tenth grade scores increase.** The At-risk Factor is related negatively to tenth grade test scores.
- **As the size of an LMC's staff and collection increases, tenth grade scores increase.** The LMC Size Factor is related positively to tenth grade test scores.

At-risk conditions are a very strong predictor of test performance for this grade. Indeed, this is the strongest such relationship demonstrated for the grades under study. LMC size is not entirely overwhelmed; but, its predictive power is greatly reduced, adding only seven percent to the 51 percent of test score variation explained by at-risk conditions.

The final regression analysis of tenth grade TAP reading scores with the At-risk and LMC Size Factors explained 58 percent of the variation in such scores. (See Table 5-13.) The At-risk Factor is statistically significant at the <.001 level; and, the LMC Size Factor, at the <.05 level.

TABLE 5-13
FINAL REGRESSION ANALYSIS OF TENTH GRADE TAP READING SCORES

Statistic / Variable	Multiple R	R Squared	R Square Change	Beta	Significance of T
ATRISK	.71	.51	.51	-.72	<.001
LMCSIZE	.76	.58	.07	.27	<.05

5.2.7 ACTIONS

With all other variables under consideration eliminated on either statistical or substantive grounds, the At-risk and LMC Size Factors are recognized as direct predictors of test scores for all grades under study. As at-risk conditions decrease and the size of a library media center's staff and collection increase, test scores increase. Of the nine variables with which this regression analysis began, these are the only two which demonstrate consistent direct relationships to test scores. Table 5-14 summarizes these relationships.

TABLE 5-14
SUMMARY OF FINAL PATH (BETA) COEFFICIENTS FOR At-risk & LMC SIZE FACTORS WITH TEST SCORES BY GRADE

Variable / Grade	Test Score Predictor	
	At-risk Factor	LMC Size Factor
1st	-.51	.23
2nd	-.45	.39
4th	-.33	.35
5th	-.37	.30
7th	-.40	.47
10th	-.72	.27

5.3 SUMMARY

Notably, the importance of the At-risk Factor is highest for first and tenth grades, while the LMC Size Factor rivals its importance in the intervening grades. Generally, the results for different grades should be regarded simply as results for different samples. Such findings, however, probably reflect accurately a stronger negative relationship between at-risk conditions and academic achievement at the beginning and end of a student's school career. Young pupils enter the educational system with substantial advantages or disadvantages depending on their socio-economic origins. As older students approach graduation, the school's mitigating influences will be reduced; they begin to look toward life after commencement.

This chapter has reported in detail two series of regression analyses which identified at-risk conditions and the size of a library media center's staff and collection as the two direct predictors of test scores out of the potential predictor variables included in this study. Total and LMC expenditures per pupil, teacher-pupil ratio, and factor scores representing "career teachers," the library media specialist's role, and LMC use failed to demonstrate direct links to test scores. Their indirect links to test scores via at-risk conditions and LMC size will be assessed in the next chapter.

CHAPTER 6

TESTING THE MODEL: INDIRECT PREDICTORS OF ACADEMIC ACHIEVEMENT

The previous chapter reported the results of two series of regression analyses which identified at-risk conditions and the size of a library media center's staff and collection as predictors of norm-referenced test scores. Other variables which failed to demonstrate direct links to test scores include: total per pupil expenditures, teacher-pupil ratio, and factor scores representing "career teachers," the library media specialist's role, and LMC use. This sixth chapter examines the relationships among all of these variables and any resulting indirect relationships to test performance.

The following narrative and tables report the findings of separate regression analyses of each of these variables with the others which precede--and, therefore, may predict--it. For instance, variables considered as predictors of LMC size include: total per pupil expenditures, the teacher-pupil ratio, and factor scores representing "career teachers" and the library media specialist's role. Because this study does not involve a time series which might demonstrate a feedback loop between LMC use and size, the former variable is omitted. Similarly, variables considered as predictors of the teacher-pupil ratio include only at-risk conditions, total per pupil expenditures, and the career teachers factor. The statistical significance criteria described at the beginning of the previous chapter also apply for this series of regression analyses.

Once the direct relationships among at-risk conditions, LMC size, and other intervening predictors of test scores are established, the paths from variable to variable that create indirect links to test scores are charted.

6.1 PREDICTORS OF LMC SIZE

Six variables were considered as potential predictors of the size of a library media center's staff and collection: the At-risk Factor, Total Per Pupil Expenditures, Teacher-Pupil Ratio, LMC Expenditures, and two factor scores, Career Teacher and the LMS Role.

- **As the number of teachers in relation to pupils increases, the size of an LMC's staff and collection increases.** Predictably, there is a positive relationship between Teacher-Pupil Ratio and LMC Size. Because the LMC Size factor includes the ratio of library media staff to pupils, it is little surprise that this factor is related to the ratio of teachers to pupils. It may be worth noting, however, that these ratios are not inversely related. There does not appear to be a trade-off between classroom and library media center staffing. These two types of staffing tend to rise and fall together.

- **As the library media specialist's role increases, the size of an LMC's staff and collection increases.** There is a positive relationship between LMS Role and LMC Size. As specialists become more involved in the instructional process, needs for support staff and local access to larger collections increase.

- **As spending on materials and equipment for library media centers increases, the size of the LMC's staff and collection increases.** Perhaps least surprising, there is a positive relationship between LMC Expenditures and LMC Size. To invoke a cliche, "you get what you pay for."

Three variables explain 55 percent of the variation in LMC Size. In order of importance, they are: Teacher-Pupil Ratio, LMS Role, and LMC Expenditures. Their levels of statistical significance range from <.01 to <.001.

TABLE 6-1
REGRESSION ANALYSIS OF LMC SIZE

Statistic Variable	Multiple R	R Square	R Square Change	Beta	Significance of T
TPRATIO	.66	.44	.44	.52	<.001
LMSROLE	.72	.53	.09	.29	<.001
LMCEXP	.74	.55	.02	.15	<.01

6.2 PREDICTORS OF THE LMS ROLE

Because the library media specialist's (LMS) role is a predictor of LMC Size, variables linked to the LMS Role were identified. Five variables were considered as potential predictors of the LMS Role: the At-risk Factor, Total Per Pupil Expenditures, Teacher-Pupil Ratio, LMC Expenditures, and the Career Teacher Factor.

As the ratio of teachers to pupils increases, the library media specialist's role increases. One variable, Teacher-Pupil Ratio, explains 10 percent of the variation in LMS Role and is statistically significant at the <.001 level. This positive relationship reflects the dependence of the LMS role on an adequate level of LMC staffing as well as a link between good working conditions--in this case, the ratio of professionals to pupils--for both teachers and library media specialists. Neither can be expected to perform well when overwhelmed by excessive numbers of pupils. In the case of library media specialists, they cannot be expected to play an integral instructional role if they must police traffic in the LMC.

TABLE 6-2
REGRESSION ANALYSIS OF LMS ROLE

Statistic Variable	Multiple R	R Square	R Square Change	Beta	Significance of T
TPRATIO	.31	.10	.10	.31	<.001

6.3 PREDICTORS OF LMC EXPENDITURES

Because LMC Expenditures predict LMC Size, variables linked to LMC Expenditures were identified. Four variables were considered as potential predictors of LMC Expenditures: the At-risk Factor, Total Per Pupil Expenditures, Teacher-Pupil Ratio, and the Career Teacher Factor.

- **As total per pupil expenditures increase, so do LMC expenditures.** Predictably, the relationship between total per pupil expenditures and LMC expenditures is a positive one.

- **Schools in communities less at risk tend to spend more on LMCs.** It is little surprise that there is an inverse relationship between at-risk conditions and LMC expenditures.

- **As the number of teachers relative to pupils increases, LMC expenditures increase.** There is a positive relationship between the teacher-pupil ratio and LMC expenditures. This is yet another case where it is noteworthy that there is not a negative relationship. There does not appear to be a trade-off between having an adequate teaching staff and having an adequately stocked and equipped LMC. Schools with higher LMC expenditures also tend to have higher teacher-pupil ratios. Evidently, it is not a matter of choosing between the two.

Seventeen percent of the variation in LMC Expenditures is explained by these three variables: Total Per Pupil Expenditures, the At-risk Factor, and Teacher-Pupil Ratio. Their levels of significance range from <.01 to <.001.

TABLE 6-3
REGRESSION ANALYSIS OF LMC EXPENDITURES

Statistic Variable	Multiple R	R Square	R Square Change	Beta	Significance of T
EXPTOTAL	.31	.10	.10	.28	<.01
ATRISK	.37	.14	.04	-.23	<.001
TPRATIO	.41	.17	.03	.20	<.01

6.4 PREDICTORS OF TEACHER-PUPIL RATIO

Because the teacher-pupil ratio predicts the LMS role and LMC expenditures, variables linked to the teacher-pupil ratio were identified. Three variables were considered as potential predictors of Teacher-Pupil Ratio: the At-risk Factor, Total Per Pupil Expenditures, and the Career Teacher Factor.

- **As schools spend more generally, they tend to employ greater numbers of teachers in relation to their enrollments.** Not surprisingly, total per pupil expenditures and teacher-pupil ratio are related positively. Of course, a school's teacher-pupil ratio is largely a matter of what it can afford.
- **Schools less subject to at-risk conditions tend to have higher teacher-pupil ratios.** Similarly, a predictable inverse relationship was found between at-risk conditions and teacher-pupil ratio.

These two variables, Total Per Pupil Expenditures and the At-risk Factor, explain 34 percent of the variation in Teacher-Pupil Ratio. Their levels of significance are <.001 and <.05, respectively.

TABLE 6-4
REGRESSION ANALYSIS OF TEACHER-PUPIL RATIO

Statistic / Variable	Multiple R	R Square	R Square Change	Beta	Significance of T
EXPTOTAL	.57	.32	.32	.57	<.001
ATRISK	.58	.34	.01	.11	<.05

6.5 INDIRECT PREDICTORS OF TEST SCORES VIA LMC SIZE

Three variables predict LMC size: LMC expenditures, the library media specialist's role, and the teacher-pupil ratio. Because LMC size predicts academic achievement, these three predictors of LMC size also predict such achievement indirectly.

- **LMC expenditures predict test scores via LMC size.** As expenditures on library media centers increase, the size of LMC staff and collections tend to increase, and, in turn, test scores tend to increase.

- **The LMS role predicts test scores via LMC size.** As the instructional role of the library media specialist increases, the size of LMC staff and collections tend to increase, and, in turn, test scores tend to increase.

- **The teacher-pupil ratio predicts test scores via LMC size.** As the teacher-pupil ratio increases, the size of LMC staff and collections tend to increase, and, in turn, test scores tend to increase.

Figure 6-1 illustrates the indirect links between these three variables and test scores.

FIGURE 6-1
INDIRECT PREDICTORS OF
TEST SCORES VIA LMC SIZE

LMCEXP -------------------> LMCSIZE --------------------> ITBS/TAP
LMSROLE ---------------->
TPRATIO ----------------->

6.6 INDIRECT PREDICTORS OF TEST SCORES VIA LMC SIZE & LMC EXPENDITURES

Three variables predict LMC Expenditures: Total Per Pupil Expenditures, Teacher-Pupil Ratio, and the At-risk Factor. Because LMC expenditures predict LMC size and it, in turn, predicts academic achievement, the three predictors of LMC expenditures also predict test scores indirectly.

- **Total per pupil expenditures predict academic achievement via LMC expenditures and their relationship to the size of an LMC's staff and collection.** As total per pupil expenditures increase, LMC expenditures increase. As LMC expenditures increase, LMC size increases. And, as LMC size increases, test scores increase.

- **The teacher-pupil ratio predicts academic achievement via LMC expenditures and their relationship to the size of an LMC's staff and collection.** As teacher-pupil ratio increases, LMC expenditures increase. As LMC expenditures increase, LMC size increases. And, as LMC size increases, test scores increase.

- **At-risk conditions predict academic achievement via LMC expenditures and their relationship to the size of an LMC's staff and collection.** As at-risk conditions decrease, LMC expenditures increase. As LMC expenditures increase, LMC size increases. And, as LMC size increases, test scores increase.

Figure 6-2 illustrates the indirect links between these three variables and test scores.

FIGURE 6-2
INDIRECT PREDICTORS OF
TEST SCORES VIA LMC SIZE & LMC EXPENDITURES

EXPTOTAL --------------------> LMCEXP ----------------> LMCSIZE ----------------> ITBS/TAP
TPRATIO ----------------------->
ATRISK (-) --------------------->

6.7 TEACHER-PUPIL RATIO AS A PREDICTOR OF TEST SCORES VIA LMC SIZE & THE LMS ROLE

Teacher-pupil ratio predicts the library media specialist's role. Because the LMS role predicts LMC size and that, in turn, predicts test scores, teacher-pupil ratio predicts test scores indirectly.

The teacher-pupil ratio predicts academic achievement via that ratio's link to the instructional role and its relationship to the size of an LMC's staff and collection. The instructional role of the library media specialist (LMS) is only possible when the teacher-pupil ratio permits teachers to participate in such collaboration. As the teacher-pupil ratio increases, the library media specialist's role increases. As the LMS role increases, LMC size increases. And, as LMC size increases, test scores increase.

Figure 6-3 illustrates the link between teacher-pupil ratio and test scores via LMC size and LMS role.

FIGURE 6-3
TEACHER-PUPIL RATIO AS A
PREDICTOR OF TEST SCORES VIA
LMC SIZE & LMS ROLE

TPRATIO -----------------------> LMSROLE --------------> LMCSIZE --------------> ITBS/TAP

6.8 INDIRECT PREDICTORS OF TEST SCORES VIA LMC SIZE & TEACHER-PUPIL RATIO

Two variables predict the teacher-pupil ratio: total per pupil expenditures and the at-risk factor. Predictably, the ratio of teachers to pupils and that of LMC staff to pupils (one of the components of the LMC Size Factor) are related. Because the teacher-pupil ratio predicts LMC size and it, in turn, predicts academic achievement, these two variables also predict such achievement indirectly.

- **Total per pupil expenditures predict academic achievement indirectly via their relationship to the teacher-pupil ratio and LMC size.** As total per pupil expenditures increase, teacher-pupil ratio increases. As teacher-pupil ratio increases, LMC size increases. And, as LMC size increases, test scores increase.

- **At-risk conditions predict academic achievement indirectly via their relationship to the teacher-pupil ratio and LMC size.** As at-risk conditions decrease, teacher-pupil ratio increases. As teacher-pupil ratio increases, LMC size increases. And, as LMC size increases, test scores increase.

Figure 6-4 illustrates the indirect links between these two variables and test scores.

FIGURE 6-4
INDIRECT PREDICTORS OF
TEST SCORES VIA LMC SIZE & TEACHER-PUPIL RATIO

EXPTOTAL --------------------> TPRATIO ---------------> LMCSIZE ----------------> ITBS/TAP
ATRISK (-) ---------------------->

6.9 SUMMARY

This chapter identified the LMS role, LMC expenditures, and the teacher-pupil ratio as predictors of LMC size, which, in turn, predicts test scores. It also identified at-risk conditions and total per pupil expenditures as predictors of some of these predictors. The direction and strength of these relationships were determined via regression analysis, and the indirect paths leading from variable to variable to LMC size to test scores were charted to make them as readily understandable as possible. Figure 6-5 summarizes both the direct relationships verified in Chapter 5 and the indirect relationships verified in this chapter.

In the concluding chapter, all of this study's findings will be summarized and the path model they confirm will be presented. The conclusions to be drawn from this study will be placed in context with previous research on library media centers and academic achievement. Limitations of this study and unforseen issues which arose during it which might be addressed by future research on this topic will also be identified.

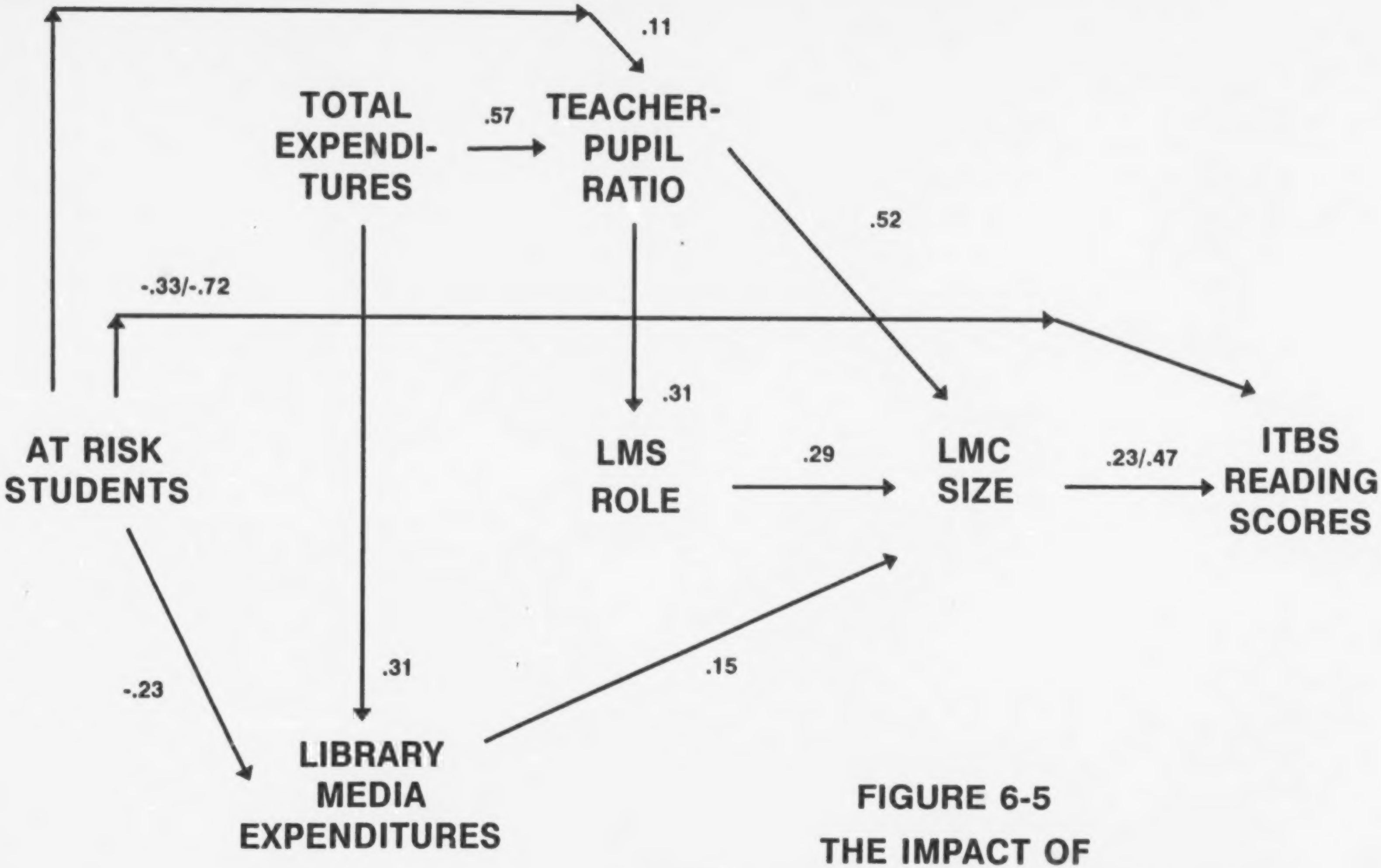

FIGURE 6-5
THE IMPACT OF
SCHOOL LIBRARY MEDIA CENTERS ON
ACADEMIC ACHIEVEMENT
A PATH MODEL

CHAPTER 7

CONCLUSION

The two preceding chapters reported the results of statistical tests used to assess a particular model of academic achievement. Several aspects of library media service were identified as direct and/or indirect predictors of such achievement. This final chapter reviews those findings, answers the questions posed in this study, offers suggestions for strengthening future research on this topic, identifies practical uses for this study's findings, and outlines some of the next steps to be taken by the Study Team in the wake of this report's publication.

7.1 FINDINGS

In assessing the impact of school library media centers on academic achievement, potential predictors were drawn from the LMC as well as its school and community contexts. All potential predictors for which data were available were considered. Following is a summary of the findings reported in preceding chapters:

- **The size of a library media center's staff and collection is the best school predictor of academic achievement.** Students who score higher on norm-referenced tests tend to come from schools which have more library media staff and more books, periodicals, and videos.

- **The instructional role of the library media specialist shapes the collection and, in turn, academic achievement.** A library media center should be staffed by an endorsed library media specialist who is involved not only in identifying materials suitable for school curricula, but also in collaborating with teachers and others in developing curricula. These activities require that the media specialist have adequate support staff. This involvement in the instructional process helps to shape a larger--and, presumably, more appropriate--local collection. Students who score higher on norm-referenced tests tend to come from schools where this instructional role is more prominent.

- **The degree of collaboration between library media specialist and teachers is affected by the ratio of teachers to pupils.** Collaboration of this type depends on the availability of both media specialist and teacher to engage in this important work. Specialists who play an instructional role tend to have teacher-colleagues whose workloads also permit such collaboration.

- **Library media expenditures affect LMC staff and collection size and, in turn, academic achievement.** Not surprisingly, the size of the LMC collection is related to the amount of funding available for such purposes. Students who score higher on norm-referenced tests tend to come from schools which spend more on library media programs.

- **Library media expenditures and staffing vary with total school expenditures and staffing.** It is also little surprise that the funding and staffing levels of library media programs rise and fall along with those of other school programs.

- **Among school and community predictors of academic achievement, the size of the LMC staff and collection is second only to the absence of at-risk conditions, particularly poverty and low educational attainment among adults.**

7.2 QUESTIONS & ANSWERS

This study was undertaken to answer three questions about the relationship between library media programs and academic achievement. Following are those questions and the answers based on the findings of this research:

- *Is there, in fact, a relationship between expenditures on LMCs and test performance, particularly when social and economic differences between communities and schools are controlled?* Yes. Students at schools with better funded LMCs tend to achieve higher average test scores, whether their schools and communities are rich or poor and whether adults in the community are well or poorly educated.

- *Assuming that there is a relationship between LMC expenditures and test performance, which intervening characteristics of library media programs help to explain this relationship?* The size of an LMC's total staff and the size and variety of its collection are important characteristics of library media programs which intervene between LMC expenditures and test performance. Funding is important; but, two of its specific purposes are to ensure adequate levels of staffing in relation to the school's enrollment and a local collection which offers students a large number of materials in a variety of formats.

- *Does the performance of an instructional role by library media specialists help to predict test performance?* Yes. Students whose library media specialists played such a role--either by identifying materials to be used with teacher-planned instructional units or by collaborating with teachers in planning instructional units--tend to achieve higher average test scores.

These documented answers to these questions comprise the unique contribution of this study to the research literature on the impact of school library media centers on academic achievement.

7.3 SUGGESTIONS FOR FUTURE RESEARCH

Both the sample and the data involved in this study are subject to limitations which should be overcome by future research.

7.3.1 SAMPLING

The sample for this study was 221 of 1,331 Colorado public schools. The representativeness of this 17 percent sample of Colorado public schools--both of all Colorado public schools and of U.S. public schools--is open to question. There were two self-selection factors: participation in a 1988-89 survey of Colorado school library media centers and use of the Iowa Tests of Basic Skills (ITBS) and/or Tests of Achievement and Proficiency (TAP). A comparison of the sample schools and all Colorado public schools found the two groups to be similar in composition by school level, enrollment, and district setting. It is conceivable, however, that some other characteristic might distinguish the sample schools from the Colorado public school universe.

Because the overall sample was relatively small, numbers of schools involved in this analysis at upper grade levels were sometimes quite small. A larger overall sample would probably eliminate this problem.

These concerns about the study's sample will be overcome as the study is replicated in other states. As Colorado schools were not required to use the same norm-referenced tests or to provide LMC data, any state which requires either or both of these conditions is an advantageous site for replication.

7.3.2 DATA

The study is also limited in terms of its data--both some of that used and some of that not available. By far the greatest data limitation is the use of norm-referenced test scores to operationalize academic achievement. During this study, a revolution in testing has begun. Norm-referenced tests, such as those employed in this research, are being replaced by "authentic assessment" techniques. While this revolution in assessment promises a more accurate reflection of what students learn, quantitative--or, at least, quantifiable--measurements based on such assessment will be necessary for them to supplant norm-referenced test scores in educational research.

Although many potential LMC, school, and community predictors were weighed in this study, many other recognized predictors could not be considered for lack of available data on them. While the economic and educational conditions implicated in this study are important at-risk conditions, the crime and drugs prevalent in many communities also influence the readiness of students to learn. Appropriate data on these social problems were not available.

Future researchers will have the advantage of access to 1990 U.S. Census data. The release of more current socio-economic data on school districts will permit them to consider community conditions which could not be taken into account in this study.

Per pupil expenditures and teacher-pupil ratio are important measures of the school environment; but, so are alternative teaching styles, the prevalence of disciplinary problems, and the student turnover rate. Data on these variables also were not available.

Spending on library media programs, the size of their staff and collections, and the role of library media specialists are identified as direct or indirect predictors of academic achievement. But, for lack of available data, it was impossible to consider the importance of how information skills are taught, how teachers and media specialists plan cooperatively, and the role of technology in LMCs. Perhaps most notably, however, most of the data involved in this study were collected just before the release of *INFORMATION POWER*, the national guidelines for school library media programs. Future research of this type should involve data on some of the important considerations identified in that landmark document.

7.4 NEXT STEPS

Sample presentations of these findings, case studies of districts and schools which exemplify them, and sample plans and budgets based on them are being developed. They will be made available in a future publication to be announced.

Other state library agencies, state departments of education, library schools, and library-related agencies are encouraged to replicate and improve upon this study in other settings. Members of the Study Team are available to provide more in-depth background information as well as consultative assistance in reviewing the literature and research in progress, designing a sample, and compiling and analyzing available data. The above-mentioned agencies will be surveyed by mail in September 1993 to determine the extent to which this study has been used, how it has been received, and how effectively it has been used. On the basis of that survey, there will be a followup report taking particular note of the development of other databases of school library media statistics, replications of this study, and citations of the study's findings.

APPENDIX A

AN ANNOTATED BIBLIOGRAPHY

THE IMPACT OF SCHOOL LIBRARY MEDIA CENTERS ON ACADEMIC ACHIEVEMENT

AN ANNOTATED BIBLIOGRAPHY

RESEARCH STUDIES

Aaron, S.L. (1975). Personalizing instruction for the middle school learner: the instructional role of the school media specialist. Tallahassee: Florida Department of Education.

The value of adding a media specialist to the teaching team was demonstrated through gains in student self-concept and academic achievement. Eighth grade students who participated in an experimental program in which a full-time media specialist was added to the teaching team showed significant improvement in language arts, spelling, and math computation over the control group. The media specialist's role was to develop, use, evaluate, and prescribe media-based learning activities which addressed individual students' diverse learning styles. In addition, students in the experimental group experienced improvement in their self-confidence.

Ainsworth, L. (1969). An objective measure of the impact of a library learning center. *School Libraries*. 18 (Winter), 33-35.

Elementary school students showed significant improvement in library skills as a result of a new fully staffed and equipped elementary school library. All fifth and sixth grade students at Maedgen Elementary School and a control school took a pre-test on library skills at the beginning of the school year, and then a post-test in the spring. There was significant improvement in the mean scores of Maedgen students from pre-test to post-test, and also between Maedgen students and the control group.

Bailey, G.M. (1970). The use of a library resource program for the improvement of language abilities of disadvantaged first grade pupils of an urban community. Doctoral dissertation, Boston College. (University Microfilms No. 70-3369)

Psycholinguistic abilities of disadvantaged first-grade students who participated in a library resource program improved over a 12-week period compared to a control group of disadvantaged students without such a program. After participating in a library resource program with activities based on books and storytelling, the experimental group showed a significant increase in total language ability and ability to express ideas compared to the disadvantaged control group.

AN ANNOTATED BIBLIOGRAPHY -- continued

Barrilleaux, L. E. (1965). An experimental investigation of the effects of multiple library sources as compared to the use of a basic textbook on student achievement and learning activity in junior high school science. Doctoral dissertation, University of Iowa, Iowa City, Iowa. (University Microfilms No. 66-03406)

This study compares the achievement of junior high school students in general science classes in which textbooks were used with classes in which students were not issued a basic textbook but instead used reference materials in the school library. Results showed that for all investigated educational outcomes, effectiveness, in terms of obtained means, systematically favored library materials without a basic textbook as compared to an issued basic textbook.

Becker, D.E. (1970) Social studies achievement of pupils in schools with libraries and schools without libraries. Doctoral dissertation, University of Pennsylvania, Philadelphia. (University Microfilms No. 70-22868)

Two fifth-grade classes in each of two elementary schools that had library services were compared with two fifth-grade classes in each of two elementary schools without library services on social studies achievement. The areas studied were: 1. Information gathering skills; 2. Skills in reading charts and graphs; 3. Map and globe skills; and 4. Specific social studies content areas. The same social studies units were taught, and students kept a weekly log of materials used. Skills and content in social studies were measured by sections of the ITBS. Results showed that the presence of a library and the guidance and function of a librarian appeared to exert significant influence on pupil achievement in information-gathering skills and in the reading of charts and maps, but not in map and globe skills.

DeBlauw, R.A. (1973) Effect of a multi-media program on achievement and attitudes of elementary and secondary students. Doctoral dissertation, Iowa State University, Iowa City, Iowa. (University Microfilms No. 73-25217)

This study compared the rate of cognitive growth of students on achievement test batteries before and after implementation of the program, and assessed post-implementation attitudes toward the program with a battery of attitude scales developed for the study. Results indicated that the program had positive but limited success in attaining its goal of improved achievement scores. Significant gains in achievement growth were noted in the areas of vocabulary and work study skills in grades one and two, and work study skills and arithmetic in grades three through eight. Academic performance of high school students was unchanged by the program. The most intelligent students generally experienced higher rates of achievement growth than did students with lower I.Q. scores.

AN ANNOTATED BIBLIOGRAPHY -- continued

Didier, E.K. Macklin. (1982). Relationships between student achievement in reading and library media programs and personnel. Doctoral dissertation, University of Michigan. (University Microfilms No. 82-14981)

The purpose of this study was to investigate the relationship between public elementary school achievement in reading and study skills and several aspects of library media programs and school finances. Data used were a statewide survey of library media programs and personnel in Michigan; district summaries of the fourth and seventh grade student scores on the reading subtest of the Michigan Educational Assessment Program; and financial data regarding school district State Equalized Valuation and expenditures for instruction.

"Major findings of the study were: 1) Student achievement in reading, study skills and use of newspapers was significantly greater at the seventh grade level in schools with library media personnel as compared to schools without; 2) Student access to the library media center was significantly greater in schools with professional library media personnel than in schools without; 3) The education of the library media specialist was inversely related to curricular role and overall student achievement in reading at the fourth grade level, and to student access at both grade levels; 4) There was a strong positive correlation between district State Equalized Valuation (S.E.V.) and instructional expenditures per pupil in districts with professional library media personnel. In districts without such personnel, there was no correlation between the two factors." DAI Abstract

Didier, E.K. (1984). Research on the impact of school library media programs on student achievement. Atlanta, GA: Paper presented at the Annual Meeting of the American Association of School Librarians, November 2, 1984. (ERIC Document Reproduction Service No. ED 279 340)

This report summarizes an investigation of the relationship between public elementary school students' achievement in reading and study skills and several aspects of the library media program. Data were collected from a statewide survey of library media programs and personnel, district summaries of reading achievement scores for fourth and seventh graders, and financial data regarding State Equalized Valuation (SEV) and per-pupil expenditures for instruction. Academic performance of high school students was unchanged by the program. The most intelligent students generally experienced higher rates of achievement growth than did students with lower I.Q. scores.

Major findings include the effect of professional personnel in schools on student achievement in reading, study skills, and use of newspapers at the seventh-grade level, and student access to the library media center; the curricular role of the library media specialist relative to student achievement in reading at the fourth-grade level; the correlation in districts with professional library media personnel between SEV and

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instructional expenditures per pupil and between overall student achievement in reading and instructional expenditures; the likelihood of districts with higher SEV and total instructional expenditures per pupil having professional media personnel at the elementary level; and the relationship of educational background of the library media specialist to his/her curricular role, overall student achievement in reading at the fourth-grade level, and student access at both levels. A summary of related research and a 37-item bibliography are provided. (ERIC Abstract)

Ducat, M.P.C. (1960). Student and faculty use of the library in three secondary schools. Doctoral dissertation. Columbia University, New York City. (University Microfilms No. 60-2449)

The purposes of this study were to determine the nature and extent of library use among 2266 students and 108 teachers in three parochial secondary schools in the Midwest. Questionnaires obtained information on student and faculty use of and attitudes toward the library. Records of actual use were obtained for a typical week. Supplementary data from 932 students in one school supplied information for a depth study of the characteristics (sex, grade, I.Q., academic class rank, and reading level) of these students in relation to their use of public and school libraries.

Findings showed that: 1) Assignments did not motivate students to use library resources and were largely textbook centered; 2) Only a small percentage of the total school enrollment made regular or frequent visits to the school library. Less than one-half the students used the library weekly; three-fourths used it monthly; one-fifth never or rarely used it. 3) A greater proportion of better students made use of the school library than the students or lesser ability; 4) The public library was used as a complement to the school library. Overall, there was little evidence that the school library played a vital role in the total program of the schools investigated.

Eisenberg, M.B. (1988). The transferability of library research skills from high school to college. *School Library Media Quarterly*, 17 (4), 45-46.

This article abstracts research done by M. Elspeth Goodin of Kittatinny Regional High School in Newton, New Jersey. One hundred fifty-nine seniors from college preparatory English classes were divided into a control and an experimental group. The experimental group received a series of lessons on the research process, and were assigned a research paper with one week of scheduled library time. The control group was also assigned a research paper, but without the library instruction. Research papers were graded by college English professors. Both groups received a pre-test and post-test on basic college library information knowledge. High school students who received the instruction scored significantly higher on the post-test of basic college library information than the control group. Students in the experimental group also produced research papers more acceptable at the college freshman level, and were consistently more positive in their feelings of confidence in using the college library than students in the control group.

el-Hagrasy, S. (1961). The teacher's role in library service; an investigation and its devices. Doctoral dissertation, Rutgers University. (University Microfilms No. 61-4185)

This study supported the hypothesis that: a) when a teacher's reading habits and library backgrounds are significantly low, then the reading and library skills of his class are also significantly low; and b) When the reading and library skills of a class are significantly high, then the teacher's reading habits and library backgrounds must have been at least relatively high. The sample consisted of 18 teachers and 161 sixth grade children in two schools.

Fortin, C.C. (1970). The relation of certain personal and environmental characteristics of school librarians to their life values and work satisfactions. Doctoral dissertation, University of Minnesota. (University Microfilms No. 82-14981)

This study was designed to measure the assumption that a typical school librarian has an identifiable set of values and satisfactions in his or her work unrelated to his or her education, teaching role, or experiences. A sample of 783 Wisconsin public school librarians filled out a questionnaire and Allport-Lindzey Study of Values. The major conclusions were: 1) the profile of values upholds the traditional stereotype of the school librarian; 2) school librarians were generally satisfied with their work, but somewhat disenchanted with working conditions; 3) school librarians differ most over satisfactions with administrative and service aspects of the work; and 4) the impact of the library on the educational program is strongly related to the satisfied librarian.

Gaver, M.V. (1963) *Effectiveness of centralized library service in elementary schools* (2nd ed.) New Brunswick, New Jersey: Rutgers.

Higher education gains in reading and library skills were achieved by elementary students who used a professionally staffed school library. Three categories of elementary school library services were examined: 1) classroom collections; 2) centralized collections cared for by teachers or parent volunteers; and 3) school libraries directed by librarians. Gaver's purpose was to develop an instrument which would aid in the evaluation of the effectiveness of library services provided in these settings, and then to carry out this evaluation. An analysis of responses from 271 schools in 13 states clearly demonstrated that both the quality and quantity of reading were substantially superior in the school library category. Student library skills were also found to be noticeably better in schools in which a librarian was involved.

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Gengler, C.R. (1965). A study of selected problem-solving skills comparing teacher-instructed students with library/teacher-instructed students. Doctoral dissertation, University of Oregon, Eugene, Oregon. (University Microfilms No. 65-12, 215)

The main question under consideration was, "What differences exist in the ability to apply selected problem solving skills between sixth grade pupils who are instructed by a classroom teacher and those who receive additional instruction from an elementary school librarian?" One hundred eighty-eight randomly selected sixth grade students in 23 Oregon elementary schools were divided into two groups, one instructed by a teacher, and the other by both teacher and librarian. The students were all administered a Problem Solving Skills Examination and two questionnaires. The examination included both oral and written components, and the questionnaires collected data on the libraries and librarians.

Findings showed that the mean score for the librarian-teacher instructed group was significantly higher than for the teacher instructed group. This result indicates that qualified librarians can assist classroom teachers in developing problem solving abilities of elementary school children.

Gilliland, M.J. (1986). Can libraries make a difference: Test scores say, "Yes!". *School Library Media Quarterly* 15 (2), 67-70.

A senior high school library review involving cooperative learning, analysis and problem solving skills was initiated for all students in twelfth-grade English at Mission Bay High School in San Diego. During the years following implementation of the review of student locational skills, twelfth grade scores on the study-locational portion of the California Assessment Program have improved.

Greve, C.L. (1974). The relationship of the availability of libraries to the academic achievement of Iowa high school seniors. Doctoral dissertation, University of Denver, Denver, Colorado. (University Microfilms No. 75-01870)

This research tested whether students who attended high schools where higher levels of library service were available attained higher levels of academic achievement than students with lesser amounts of library service available to them. Level of library service was measured by an index containing such variables as number of volumes for school library and public library and per pupil-per capita expenditures for school and public library. Academic achievement was measured by the iowa Tests of Educational Development as well as a battery of nine other tests. Seniors at 232 Iowa high schools were tested.

Results indicated a positive relationship between level of library service available and students' scholastic achievement. The most valuable predictor of student test scores was number of volumes in the school library, followed by public library expenditures, number of volumes in the public library, and school library expenditures. The study also revealed that as the population of cities increases, so does the level of library service available to the students. In addition, students attending larger high schools have a higher level of library service available than do students in the smaller schools.

Hale, I.W. (1969). The influence of library services upon the academic achievement of twelfth grade students at Crestwood Senior High School, Chesapeake, Virginia. Athens, Georgia: Georgia University, Department of Library Education. (ERIC Document Reproduction Service No. ED 047 694)

One of the biggest problems in education is that of showing the necessity for the provision of library services and demonstrating the difference it makes in academic achievement. An even bigger difficulty, perhaps, has been the existence and application of instruments capable of giving statistical evidence. The problem of this study was to determine if library services, meaning of orientation, extent, use, and accessibility of books, materials, equipment and services by a qualified librarian, would produce a measurable increase in academic achievement over that of students who are not exposed to similar resources. The investigation involved two groups of twelfth grade students. One group used extensive library services with independent study under a librarian's supervision; in the other group library services were incidental. Comparing College Verbal Scholastic Aptitude Test scores for each group before and after the study, it is evident that academic achievement can accrue when students are exposed to library services. (ERIC Abstract)

Hale, I.W. (1970). October inspiration: School libraries work! *Wilson Library Bulletin*, 45 (2), 127.

Research was conducted at Crestwood Senior High School in Chesapeake, Virginia to determine if school library services, with a qualified librarian, would produce a measurable increase in academic achievement over that of students who would not be as highly exposed to library resources. One class of twelfth grade students was given a variety of library services and resources, with the opportunity to work independently under supervision of the librarian, while a second matched class was taught and supervised by classroom teachers, with only incidental exposure to the library. Results demonstrated that academic achievement improved for the students exposed to library skills and services. In addition, there was a "remarkable enthusiasm" for learning demonstrated among the experimental group.

AN ANNOTATED BIBLIOGRAPHY -- continued

Harkin, W.D. (1971). Analysis of secondary school library media programs in relation to academic success of Ball State University students in their freshman and sophomore years. Doctoral dissertation, Ball State University, Muncie, Indiana. (University Microfilms No. 72-07508)

Using SAT mathematics and English scores, college grade point averages, and a questionnaire, this study was designed to determine whether or not the availability and use of media in secondary school library media programs contributes to post-secondary success. A sample of 200 students representing 20 Indiana secondary schools was used. Ten of the schools had a high media-student ratio, and ten had a low media-student ratio. No marked differences were found in the academic records of the low media-student ratio group when college grade point average was used as a measure of success. There were no marked differences in opinions and values stated by the students with a high media-student ratio when compared with responses from the low media-student ratio group.

Harmer, W.R. (1959). The effect of a library training program on summer loss or gain in reading abilities. Doctoral dissertation, University of Minnesota. (University Microfilms No. 60-968)

A sample of 16 fourth grade classes of the Minneapolis Public School system were studied to examine the effect of training focused upon recreational reading upon summer loss or gain in reading abilities. Students were pre-tested two weeks before the end of the school year using the Lorge-Thorndike Intelligence Test, Non-Verbal Battery and Form A of the Developmental Reading Tests for the Intermediate Grades. Form B of the reading test was administered to all pupils during the first week of school in the fall. The experimental group showed some superiority in Part II, Reading to Retain Information and Part V, Reading to Appreciate. Girls were found to score significantly better than boys in both the experimental and the control groups.

Hastings, D.M. & Tanner, D. (1963). The influence of library work in improving English language skills at the high school level. *Journal of Experimental Education*, 31 (4), 401-405.

The purpose of this study was to determine whether improved English language skills could be developed at the tenth-grade level through systematic library experiences rather than the traditional emphasis on formal English grammar. Subjects were four matched tenth-grade English classes in a large San Francisco high school. All four groups were given the California Language Test, Form W, as a pre-test and the California Language Test, Form X as a post-test. The end of course tests for all groups were the

Durost-Center Word Mastery Test and the Iowa Tests of Educational Development, Use of Sources of Information. Both experimental groups made systematic use of the school library, while one of them also spent considerable time on learning traditional grammar and spelling. The two control groups spent virtually no time in systematic library work. The experimental group that eliminated all traditional emphasis on formal grammar and spelling, and provided systematic work in the use of library references attained a higher level of English language skills that was statistically superior to the other three groups which emphasized the traditional work in grammar and spelling. The aggregate experimental groups achieved significantly higher scores in spelling, mechanics of English, and total language skills than the control groups.

Hodges, Y., Gray, J. & Reeves, W. J. (1985). High school students' attitudes towards the library media program -- What makes the difference? *School Library Media Quarterly*, 94 (4), 183-190.

The purposes of this study by the Calgary Board of Education in Alberta, Canada, were to: 1) ascertain what services were being provided in library media programs; 2) to measure the resources required to establish media programs and 3) to assess the impact of media programs on student skills. Audio visual related services of school library media centers strongly correlated with indicators of student attitude and media center use.

Hopkins, D.M. (1989). Elementary school library media programs and the promotion of positive self-concepts: A report of an exploratory study. Library Quarterly, 59(2), 131-147.

The results of this exploratory, observational case study of three elementary school library media centers in Wisconsin suggest that library media centers can play a positive role in developing positive self-concepts in children as one way of contributing to academic achievement. The purpose of the study was to determine whether elementary school library media center programs with full-time library media specialists, full-time aides, flexible scheduling at least 25% of the time, and a variety of print and audiovisual materials provided a program to promote the development or enhancement of positive self-concepts in elementary school children. The six self-concept factors examined were cooperation, independence, success, positive atmosphere, challenge, and feeling of value or acceptance. Previous research shows a positive relationship between the development of positive self concepts in students and the presence of these factors in the school setting. Through observation and interviews strong and consistent evidence was found that all six factors were present in each library media center studied.

AN ANNOTATED BIBLIOGRAPHY -- continued

Hutchinson L.F. (1982). The relationship between library use and academic category among tenth grade students. *Clearing House*, 56 (1), 34-37.

Data was collected to determine if the 269 tenth-grade students in the study would use the school library at least three times a week if they knew how to locate the materials they needed; and if their nine English teachers thought that student response to assignments could be strengthened if the students had a knowledge of the library. Students participated in instruction emphasizing library skills and activities with practice and application from their English teacher over a two-week period. At three different times during the study (Time 1 prior to the first instructional unit; Time 2 upon completion of the two-week training; Time 3 eight weeks after completion of the unit), students were given the same ten-item questionnaire to determine their existing, as well as long-range, usage and knowledge of the library. The nine English teachers were also given a ten-item questionnaire to determine their opinions of increased student perception, knowledge, and increased use of the library. The percentage of A-B students using the library increased from 13.0 before the instruction to 91.5 eight weeks after completion of the unit; the percentage of C-D students using the library increased from 14.0 (prior) to 91.5 (eight weeks later). The results indicate that academic category does not make a significant difference if library skills and usage are taught, practiced, and applied.

Kelsey, A.P. (1976). A study of the criteria for the effectiveness of secondary school libraries as perceived by selected student clients. Doctoral dissertation, Miami University, Oxford, OH. (University Microfilms No. 77-01003)

The purpose of this study was to examine student perceptions of criteria for effectiveness of their high school libraries and to analyze the criteria in relation to similarity to present conventional evaluative criteria. Two hundred students completed a questionnaire. The criterion which was rated highest by the students was library services and materials. The second most important criterion for effective libraries was the librarian, followed by atmosphere, time and schedule limitations, and physical facilities.

Koga, S. & Harada, T. (1989). Academic achievement and the school library: An international study. Paper presented at International Federation of Library Associations General Conference and Council Meeting, School Libraries Section, Paris, 1989.

Two sets of questionnaires on academic achievement and library media skills were distributed to students, age 12, in Australia, Japan, Korea, and Thailand. Findings are summarized as follows: 1) High and positive correlation exists between the students' library use and interest in the subject study; 2) Those who have a keen attitude toward learning tend to use the library more often and, as a consequence, have better academic achievement. 3) Therefore, provision of libraries and library services should support better academic achievement among students.

Two sets of questionnaires, one on social studies and the other on library media skills, were sent to twelve-year-old students in Australia, Japan, Korea, and Thailand. A total of 374 students responded to both questionnaires and were used in the study. Korean students used the library most, followed by Australian, Thai, and Japanese students. The majority of students responding (210) were from Japan. However, a uniform teaching approach in Japan does not allow Japanese students time to use the library voluntarily during school time. The findings indicated a high and positive correlation between the students' library use and interest in social studies. Students with a keen attitude toward learning tended to use the library more often.

Loertscher, D., Ho, M.L. & Bowie, M.M. (1987). "Exemplary elementary schools" and their library media centers: A research report. *School Library Media Quarterly*, 15 (3), 147-153.

This study examined library media programs in the 209 public schools of the 270 elementary schools recognized as exemplary by the U.S. Department of Education in 1986. Nineteen statements on library media services were developed covering the categories of: 1) instructional development services to teachers; 2) other important services to teachers; 3) services to students; and 4) collections. Results found that staffing was the single most important variable in an excellent library media program. Critical staffing consisted of a full-time professional and a full-time clerical person.

Loertscher, D.Y. & Land, P. (1975). An empirical study of media services in Indiana elementary schools. *School Library Media Quarterly*, 4 (1), 8-18.

This study measured the perception of media staff, teachers, and students concerning services received from the elementary school media center, including variety of services, frequency of these services, and the dispersal of these services among teachers and students in the school. In summarizing their major conclusions, the authors state, "The variety and frequency of services given by the media staff is often disappointing. However, full-time media specialists give a significantly greater number of services than do either part-time professionals or full-time clericals. Most centers still emphasize the traditional acquisition, accessibility, and some utilization services. The media staff need to make a greater effort to communicate their service program to the teachers in their schools. Services in the areas of instructional development, evaluation, production, professional development, and utilization are either not frequently offered or teachers are not made aware of their existence."

McConnaha, V. (1972). The effect of an elementary school library at high school level. *California School Libraries*, 43 (Summer), 24-29.

This article describes research completed for a Master's in Librarianship. Students in the study were enrolled in ninth grade and had previously attended elementary schools which had a variety of library facilities. A multiple choice test, administered in ninth grade English classes to 300 students, was designed by the librarian to measure library skills in the areas of the card catalog, dictionary use, encyclopedias, common reference titles, and use of the Readers' Guide. A cover sheet was attached to each test requesting information regarding elementary school library service, other libraries used, books read, and movies seen during the previous year. Students' scores were significantly highest among those who had attended the elementary school with a library and librarian who conducted a strong library skills program. Academic achievement determined by students on the first semester honor roll at the high school showed a positive correlation with library facilities, staffing, and services provided in elementary schools. The study found a direct correlation between library experience at elementary school and the use of outside libraries.

McMillen, R.D. (1965). An analysis of library programs and a determination of the educational justification of these programs in selected elementary schools of Ohio. Doctoral dissertation, Western Reserve University, Cincinnati, Ohio. (University Microfilms No. 66-08017)

One of the four purposes of this study was to determine the degree to which selected elementary school library media programs in Ohio have led to the improvement of academic achievement. Students in schools with good libraries and full-time librarians performed at a higher level in reading comprehension and in knowledge and use of reference materials than students in schools with minimal or no library service.

Roser, N.L., & Farest, C. (1990). Language, literature, and at-risk children. *The Reading Teacher*, 43 (8), 554-559.

Explores the effects of the Language to Literacy project in six schools of the Brownsville Independent School District, which has a large population of at-risk children. School libraries were not extensive in these schools, and the emphasis was on getting literature into the classrooms. Results indicated that five of the six schools made significant growth in their scores on the state-mandated test of basic skills (TEAMS). Of the five area schools cited as among the most improved in the state, three were participants in the Language to Literacy program.

AN ANNOTATED BIBLIOGRAPHY -- continued

Schon, I. (1984). The effects of a special school library program on elementary students' library use and attitudes. *School Library Media Quarterly*, 12 (3), 227-231.

The effects of a special school-library initiated and library-based motivational program on library use, library attitudes, and reading attitudes of elementary school students was studied with 300 sixth graders in Phoenix, Arizona schools. The experimental group participated in a 20-week, 30 minute per week, special library program on recommended high-interest topics while the control students had study hall or worked on special projects with their regular classroom teacher. During the 20 weeks of study, the experimental group greatly exceeded the control group on library media center use (increasing 101 per cent for classroom-related use and 103 per cent for non-classroom-related use). Improved students' attitudes and use of the library media center seemed to motivate school librarians to provide new services and materials for students.

Schon, I., Hopkins, K.D., Everett, J., & Hopkins, B.R. (1984-1985) A special motivational intervention program and junior high school students' library use and attitudes. *Journal of Experimental Education*, 53 (Winter), 97-101.

A special six-week library motivational program was used in seventeen Arizona junior high schools to improve students' understanding of, attitudes toward, and use of the school library. Half the students in each class participated in a special program on the topics of sports, science fiction/fantasy, how-to books/crafts/hobbies, almanacs, World War II, and scary stories designed to increase use of the library and improve attitudes toward the library/librarian and reading. The Library Attitude Scale (LAS) and the Reading Attitude Scale (RAS) were used. Student library use was monitored throughout the study. The participating librarians indicated that the experimental program was an improvement over conventional approaches and felt that working with small groups of students in a variety of carefully selected and well-organized activities was an effective way to make students more comfortable in the library and to expose them to a variety of library materials. The program was found to have a statistically significant effect on library use and library attitudes.

Thorne, L.M. (1967). The influence of the Knapp School Libraries Project on the reading comprehension and on the knowledge of library skills of the pupils at the Farrar Junior High School, Provo, Utah. Doctoral dissertation, Brigham Young University, Provo, Utah. (University Microfilms No. 67-17,224)

Reading comprehension and library skills were improved by expanded library services at Farrar Junior High School in Provo, Utah. A two-year longitudinal study of students leaving sixth grade followed their progress as they used either the augmented services of a Knapp Project library at Farrar or the nominal services of a second junior high school library. Findings revealed a significant difference in the mean gains of the experimental group over the control group in reading comprehension and library skills. Boys showed greater improvement in reading comprehension; girls, in library skills.

Walker, R. (1963). The influence of antecedent library service upon academic achievement of University of Illinois freshmen. Doctoral dissertation, University of Illinois, Champaign-Urbana, Illinois. (University Microfilms No. 64-2983)

Using college grade point averages as the measure of academic achievement, this study was designed to test whether or not the availability of high school and public library service made a significant contribution to the academic success of students at the University of Illinois. The results showed no significant difference in the grade point average for students from communities with a high level of library service available and students from communities with poor or no library service available. The level or efficacy of library use by students was not measured.

Wert, L.M. (1970). Library education and high school library services. Doctoral dissertation, University of Illinois, Champaign-Urbana, Illinois. (University Microfilms No.70-21,083)

This study demonstrated that Illinois high school librarians who held Master's in Library Science degrees developed more extensive programs of reader services and spent more time in their area than librarians having only undergraduate library education. Their libraries also had a higher frequency of use and a larger teacher use per service. In comparison, librarians with less education often spent more time on clerical, housekeeping, and teaching duties. Teachers in high schools served by librarians with more extensive library education gave more assignments per class requiring use of the library and visited the library more for class preparation. A larger percentage of their students also used the library.

Willson, E.J. (1965). Evaluating urban centralized elementary school libraries. Doctoral dissertation, Wayne State University, Detroit, Michigan. (University Microfilms No. 66-10123)

The purpose of the study was to examine whether the quality of learning is measurably strengthened for students in schools with a centralized elementary library program administered by a professional librarian. The findings demonstrated superior gains on the ITBS in the areas of reading achievement and reference skills for students in elementary schools with a centralized library and a professional librarian compared with those without a centralized library.

Yarling, J.R. (1968). Children's understandings and use of selected library-related skills in two elementary schools, one with and one without a centralized library. Doctoral dissertation, Ball State University, Muncie, Indiana. (University Microfilms No. 69-4202)

The primary purpose of this longitudinal study was to compare fourth and sixth grade children's understandings and use of selected library skills in two elementary schools, one with and one without a centralized library. The study concluded that the addition of a well-equipped and managed centralized library had a significant impact on fourth and sixth grade students in the experimental school in library-related skills, particularly in outlining and notetaking.

REVIEWS OF THE LITERATURE

Aaron, S.L. (1972). A review of selected research studies in school librarianship, 1967-1971: Part I. *School Libraries*, 21 (Summer), 29-46.

This paper reviews 58 doctoral dissertations completed between 1967 and 1971. Forty were done outside schools of library science, chiefly in education departments. Few employed experimental designs; most relied upon survey methodology. The areas covered by the dissertations are historical studies, development of secondary school libraries, development of elementary school libraries, district-wide instructional materials centers, library skills and instruction, readers' services, resources, pre-service and in-service education, perception studies, research needs, and other topics.

Aaron, S.L. (1972). A review of selected research studies in school librarianship, 1967-1971: Part II. *School Library Media Quarterly*, 21 (1), 41-48.

A study of selected research projects other than doctoral dissertations, including research projects sponsored by the U.S. Office [illegible] Education, professional associations, foundations and councils.

Barron, D.D. [illegible]977). A review of selected research in school librarianship: 1972-1976. *School Library Media Quarterly* [illegible] (4), 271-289.

This article reviews research which directly involved the school library media program or studies which included the school library media program as an aspect of research. The following categories are covered: the utilization of school library media center materials; influence of the school library media program; analysis and evaluation of school library media programs; the role of the school library media specialist; role perception studies; and miscellaneous studies.

Didier, E.K. (1984) Research on the impact of school library media programs on student achievement: Implications for school media professionals. In S.I. Aaron and P.R. Scales (Eds.), *School Library Media Annual 1984* (pp. 343-361). Littleton, CO: Libraries Unlimited.

Discusses 38 investigations of library media program impact on student achievement.

Freeman, P. (1976). Index to research in school librarianship, 1960-1974. (ERIC Document Reproduction Service No. ED 119 741)

Intended as a guide to the research, this bibliography identifies studies in the field of school librarianship published between 1960 and 1974. Studies on the schools, on the library field, and on educational media are included only when the school library/media center is identified as a major object of the research. The material is organized by topics such as: national statistics, staff, facilities, resources, and service. No annotations are given, but references to abstracts available in Dissertation Abstracts of Resources in Education are included. There are an author index and a subject and methodology index. (ERIC Abstract)

Haycock, K. (1989). Research in teacher-librarianship: The implications for professional practice. *Emergency Librarian*, 17 (1), 9-11, 13, 15, 17-18.

Each summary of "what works" includes a statement of research findings, comments and references. Topics addressed are the role of the teacher librarian, principal, and program coordinator; secondary school programs and facilities; impact on student achievement; continuing education; resources for students; dissemination of information; and personal qualities of teacher librarians. Twenty-four general reviews of research are listed.

Hodges, G.C. (1981). The instructional role of the school library media specialist: What research says to us. *School Media Quarterly*, 9 (4), 281-285.

Selected studies were examined to identify the predominant patterns in research findings related to the curricular and instructional role of the school library media specialist. The major patterns are: 1) frequency with which the school library media specialist assumes an active role in curriculum and instruction is directly related to the size of the media staff; 2) Along with a core of competencies in library science, school library media specialists most likely to assume an active role in curriculum and instruction have competencies in curriculum planning, implementation, and evaluation strategies; the analysis of materials which will achieve specific instructional objectives; instructional design; communication skills; and the ability to assume a teacher's "frame of reference."; 3) For the instructional role of school library media specialist to become widely implemented, changes in the perceptions of and expectations for the school library media specialist will have to occur. The article gives implications of the patterns for library educators, professional associations, state and district supervisors, and building level school library media specialists.

Ireland, L. H. (1991). *The impact of school library services on student academic achievement.* Livermore, CA: Petervin Press.

The author has provided an annotated bibliography of research in the area of school libraries and academic achievement, including primary sources, secondary sources, and other quotations and items of interest. 44 primary sources which include journal articles and dissertations are cited. 16 additional secondary sources are listed.

Lowrie, J.E. (1968). A review of research in school librarianship. In H. Goldhor (Ed.) *Research methods in librarianship: Measurement and evaluation.* Champaign-Urbana, IL: University of Illinois.

A review of research in school librarianship since the early 1950's, primarily at the doctoral level. Includes topics for further research.

Mancall, J.C. (1985). An overview of research on the impact of school library media programs on student achievement. *School Library Media Quarterly*, 14 (1), 33-36.

This review article is based on the presentation made by Elaine K. Didier at the July 1985 Research Forum, "Research: What Are the Questions? Where Are the Clues?", held in Chicago. Research on the impact of library media program on student achievement is summarized, implications are drawn, and recommendations for further research are made.

Marchant, M.P., Broadway, M.D., Robinson, E., & Shields, D.M. (1984). Research into learning resulting from quality school library media service. *School Library Journal*, 30(8), 20-22.

Twenty research reports examine the effect of library service on learning in the following categories: academic achievement; language, reading, and library skills; mathematics; science; social studies; and educational effect. The majority of the studies show that overall academic achievement was enhanced by library programs.

RELATED DOCUMENTS

Baldridge, S.W. & Broadway, M.O. (1987). Who needs an elementary school librarian? *Principal*, 67 (2), 37-40.

Good professional library services in elementary and secondary schools are interrelated with academic excellence. Discusses research showing the relationship between the two and stresses the need to uphold funding for library services when school budget cuts must be made.

Bernhard, P. (1989). On some theoretical foundations of the school library/media centre and their implications for education. Paper presented at the School Libraries Section, International Federation of Library Associations General Conference and Council Meeting, Paris, France.

Exploration of the theoretical foundations of the concept of the school library, expanded to encompass the library/media centre, highlights two dimensions: the environment and the media source. The library/media centre can accordingly be defined both as a stimulating environment, a place of cultural learning and information, and as a media source which provokes a variety of learning experiences and serves to diversify learning. The study of these dimensions allows us to confirm that the library/media centre has significant educational potential, and that, furthermore, it represents a factor of diversity, linked to the forces of innovation and changes. However, in order to fully realize this potential, certain minimum conditions must be met: first, in terms of human and material resources, and, second, with regard to the integration of the library/media centre with teaching and learning. (Summary by author)

Breivik, P.S. (1987). The role of libraries in the search for educational excellence. School *Library Media Quarterly*, 16 (4), 45-46.

The author champions the need for school library media specialists to focus on educational excellence. They must capture the attention of educational leaders by exploring what contributions they can make to their institution's goals and objectives. She argues that time spent on curriculum and study committees is among the best uses of personnel time, as is participating in non-library educational organizations, writing articles for non-library publications, and getting involved in affecting accreditation standards as they relate to libraries.

AN ANNOTATED BIBLIOGRAPHY -- continued

Broadway, M.D., & Baldridge, S. (1988). Prescription for excellence in instruction. *Clearing House*, 61 (February), 277-279.

This article addresses how the school library media specialist can affect academic achievement. Referring to the research linking school libraries with academic achievement, the authors encourage library media personnel to make greater efforts to inform faculty and administrators about the media center's services and to become involved in instructional design. The major responsibility of the school library media specialist is to implement the educational program by working directly with teachers and students. They must provide information skills to help children become lifelong learners.

Daniel, E.H. & Ely, D. P. (1979). Assessing the competencies of media professionals: a model for determining costs and effectiveness. (ERIC Document Reproduction Service No. ED 179 250)

Summary of the procedures and outcomes of a study undertaken to develop alternative strategies for evaluating the competencies of library media personnel in competency-based programs. The study was prompted by a realization that, although competency-based programs for school library media specialists are increasingly being adopted by state agencies as a basis for certification and by educational institutions as a procedure for educating media professionals, the effort in developing these programs has been heavily weighted toward the generation of competency statements with little attention being paid to the perhaps more difficult problem of competency assessment.

Gerhardt, L.N. (1984) AASL in Atlanta: Operation success. School Library Journal, 31 (4), 37-39.

Reports on Challenge '84: Mission Possible, the third national conference of the American Association of School Librarians in Atlanta, Georgia from October 31-November 4, 1984. The conference included papers and seminars on general educational standards, library media education, public relations, the correlation of school library media programs and student achievement, and using microcomputers in schools.

Grant, M.A. (1988) The principal's role in the achievement of learning through the library media center. *Catholic Library World*, 60 (2), 71-74.

The challenge for excellence in education and for a learning society is as vital as ever and educators agree that quality educational programs must be planned and worked for, and that the school library media program is an instructional force in the achievement of excellence. In the school where the principal understands and accepts the importance of the role of the library media specialist, and where the librarian fulfills this role within the instructional program, students will have the opportunity to learn effectively and on a

AN ANNOTATED BIBLIOGRAPHY -- continued

lifelong basis. By encouraging students and teachers to use the library media center, principals will be the catalysts in the process.

Heidegger, A. (1988). The value of a good school library. *Western European Education*, 20 (Spring), 107-112.

This articles expounds on the value of reading as the key to learning and success in school, and advocates development and use of a good school library to promote reading. The author believes a school library should contain both materials that augment classroom instruction and leisure-time reading, should be visited during regular classes, and should be open and staffed during recess and other times classes are not in session.

Kuhne, B. (1990). The Kalmar Model: The library as a tool for information and instruction in teaching. Paper presented at International Federation of Library Associations General Conference, Contributed Papers Session, Stockholm.

Information is presented on the Barkestorp Project in Kalmar, Sweden, which has been underway for two years..The project is a teaching and learning process during which elementary students investigate topics in depth using both the school and public library. The investigative method of learning is integrated into the curriculum, and the librarian and the classroom teacher work as partners. Observations are made of the way school children work after libraries have been introduced into the curriculum in a systematic and conscious way, on how they solve problems, and on the body of knowledge that they acquire.

Lowrey, A.M. & Case, R.N. (1978). Measuring program effectiveness. *Drexel Library Quarterly*, 14 (3), 12-23.

The need to continuously evaluate school library media programs based on an analysis of the goals and objectives of the program is emphasized. Evaluation is necessary to determine how the library media program facilitates learning, to improve program effectiveness, and to provide the basis for future decisions. The nature of evaluation, evaluation methods, barriers to evaluation, and the role of the supervisor in evaluation are discussed.

Lynch, M.J. & Weeks, A. (1988). School match revisited. *American Libraries*, 19 (6), 459-460.

Reports an interview with the director of School Match, a firm that has created a database of information on public and private schools to assist relocated families in identifying the best local schools. The firm's finding that library and media services' expenditures relate most significantly to student achievement is discussed.

Millbrook Press, Inc. (1990). The Millbrook report: The changing role of the school library. Brookfield, CT: Author.

One hundred seventeen school librarians from elementary, middle and high schools across the country were interviewed to determine the state of public school libraries today; to identify major trends; and to gain perspective on critical issues facing school library media specialists in the coming decade. In addition, 20 elementary school principals and 10 elementary school superintendents were interviewed from schools used in the library survey. The major findings were: 1) The average library budget for all three levels for the 89-90 school year was $7,707. Budget increases are not predicted. Librarians tended to have little, if any, fiscal involvement, which contributes to the overall lackluster performances of library budgets. 2) Library staffing has remained constant over the last five years. There is a trend in elementary schools toward shared staffing among buildings which contributes to schools which are likely not to have strong, well-integrated media programs. The flat staffing trend is predicted to continue for the next five years. 3) School librarians who were more involved in curricular activities with faculty were recognized as partners in the instructional staff and were more likely to expect increases in staffing and budgets in the next five years. 4) Major problems identified were: a) understaffing; b) the need for more resources, particularly technology; and c) time constraints.

Pretlow, D.Z., & Lilly, E.R. (1987) The library media specialist: conduit for academic achievement. *Catholic Library World*, 59 (3), 125-127.

The library media specialist has a very important role in the educational development of students. However, while the primary role of the library media specialist is seen as a teacher of the sources housed in the library, it must be accepted that although most teachers are specific in their content or specialty, the library media specialist is a generalist. Suggests ways in which these generalists can aid students in greater academic achievement.

APPENDIX B

A TIMELINE OF THE RESEARCH

THE IMPACT OF
SCHOOL LIBRARY MEDIA CENTERS
ON ACADEMIC ACHIEVEMENT

A TIMELINE OF THE RESEARCH

1950's

Harmer, W.R. (1959). The effect of a library training program on summer loss or gain in reading abilities. Doctoral dissertation, University of Minnesota. (University Microfilms No. 60-968)

1960's

Ducat, M.P.C. (1960) Student and faculty use of the library in three secondary schools. Doctoral dissertation. Columbia University, New York City. (University Microfilms No. 60-2449)

el-Hagrasy, S. (1961). The teacher's role in library service: an investigation and its devices. Doctoral dissertation, Rutgers University. (University Microfilms No. 61-4185)

Gaver, M.V. (1963). *Effectiveness of centralized library service in elementary schools.* (2nd ed.) New Brunswick, N.J.: Rutgers.

Hastings, D.M. & Tanner, D. (1963). The influence of library work in improving English language skills at the high school level. *Journal of Experimental Education*, 31(4), 401-405.

Walker, R. (1963). The influence of antecedent library service upon academic achievement of University of Illinois freshmen. Doctoral dissertation, University of Illinois, Champaign-Urbana, Illinois. (University Microfilms No. 64-2983)

Barrilleaux, L. E. (1965). An experimental investigation of the effects of multiple library sources as compared to the use of a basic textbook on student achievement and learning activity in junior high school science. Doctoral dissertation, University of Iowa, Iowa City, Iowa. (University Microfilms No. 66-03406.

Gengler, C.R. (1965). A study of selected problem-solving skills comparing teacher-instructed students with library/teacher-instructed students. Doctoral dissertation, University of Oregon, Eugene, Oregon. (University Microfilms No. 65-12,215.

A TIMELINE OF THE RESEARCH -- continued

McMillen, R.D. (1965). An analysis of library programs and a determination of the educational justification of these programs in selected elementary schools of Ohio. Doctoral dissertation, Western Reserve University, Cincinnati, Ohio. (University Microfilms No. 66-08017)

Willson, E.J. (1965). Evaluating urban centralized elementary school libraries. Doctoral dissertation, Wayne State University, Detroit, Michigan. (University Microfilms No. 66-10123)

Thorne, L.M. (1967). The influence of the Knapp School Libraries Project on the reading comprehension and on the knowledge of library skills of the pupils at the Farrar Junior High School, Provo, Utah. Doctoral dissertation, Brigham Young University, Provo, Utah. (University Microfilms No. 67-17,224)

Yarling, J.R. 1968). Children's understandings and use of selected library-related skills in two elementary schools, one with and one without a centralized library. Doctoral dissertation, Ball State University, Muncie, Indiana. (University Microfilms No. 69-4202)

Ainsworth, L. (1969). An objective measure of the impact of a library learning center. *School Libraries*, 18 (Winter), 33-35.

Hale, I.W. (1969). The influence of library services upon the academic achievement of twelfth grade students at Crestwood Senior High School, Chesapeake, Virginia. Athens, Georgia: Georgia University, Department of Library Education. (ERIC Document Reproduction Service No. ED 047 694)

1970's

Bailey, G.M. (1970). The use of a library resource program for the improvement of language abilities of disadvantaged first grade pupils of an urban community. Doctoral dissertation, Boston College. (University Microfilms No. 70-3369)

Becker, D.E. (1970). Social studies achievement of pupils in schools with libraries and schools without libraries. Doctoral dissertation, University of Pennsylvania, Philadelphia. (University Microfilms No. 70-22868)

Fortin, C.C. (1970). The relation of certain personal and environmental characteristics of school librarians to their life values and work satisfactions. Doctoral dissertation, University of Minnesota. (University Microfilms No. 82-14981)

A TIMELINE OF THE RESEARCH -- continued

Wert, L.M. (1970). Library education and high school library services. Doctoral dissertation, University of Illinois, Champaign-Urbana, Illinois. (University Microfilms No. 70-21,083)

Harkin, W.D. (1971). Analysis of secondary school library media programs in relation to academic success of Ball State University students in their freshman and sophomore years. Doctoral dissertation, Ball State University, Muncie, Indiana. (University Microfilms No. 72-07508)

McConnaha, V. (1972). The effect of an elementary school library at high school level. *California School Libraries*, 43 (Summer), 24-29.

DeBlauw, R.A. (1973) Effect of a multi-media program on achievement and attitudes of elementary and secondary students. Doctoral dissertation, Iowa State University, Iowa City, Iowa. (University Microfilms No. 73-25217)

Greve, C.L. (1974). The relationship of the availability of libraries to the academic achievement of Iowa high school seniors. Doctoral dissertation, Iowa State University, Iowa City, iowa. (University Microfilms No. 73-25217)

Aaron, S.L. (1975) Personalizing instruction for the middle school learner: the instructional role of the school media specialist. Tallahassee: Florida Department of Education.

Loertscher, D.Y. & Land, P. (1975). An empirical study of media services in Indiana elementary schools. *School Library Media Quarterly*, 4 (1), 8-18.

Kelsey, A.P. (1976). A study of the criteria for the effectiveness of secondary school libraries as perceived by selected student clients. Doctoral dissertation, Miami University, Oxford, Ohio. (University Microfilms No. 77-01003)

1980's

Didier, E.K. (1982) Relationships between student achievement in reading and library media programs and personnel. Doctoral dissertation, University of Michigan. (University Microfilms No. 82-14981)

Hutchinson, L.F. (1982). The relationship between library use and academic category among tenth grade students. *Clearing House*, 56 (1), 34-37.

A TIMELINE OF THE RESEARCH -- continued

Schon, I. (1984). The effects of a special school library program on elementary students' library use and attitudes. *School Library Media Quarterly*, 12N (3), 227-231.

Schon, I., Hopkins, K.D., Everett, J. & Hopkins, B.R. (1984-85) A special motivational intervention program and junior high school students' library use and attitudes. *Journal of Experimental Education*, 53 (Winter), 97-101.

Hodges, Y., Gray, J. & Reeves, W.J. (1985). High school students' attitudes towards the library media program -- What makes the difference? *School Library Media Quarterly*, 94 (4), 183-90.

Loertscher, D., Ho, M.L. & Bowie, M.M. (1987). Exemplary elementary schools and their library media centers: A research report. *School Library Media Quarterly*, 15 (3), 147-153.

Eisenberg, M.B. (1988). The transferability of library research skills from high school to college. *School Library Media Quarterly*, 17 (4), 45-46.

Hopkins, D.M. (1989). Elementary school library media programs and the promotion of positive self-concepts: A report of an exploratory study. *Library Quarterly*, 59 (2), 131-147.

Koga, S. & Harada, T. (1989). Academic achievement and the school library: An international study. Paper presented at International Federation of Library Associations General Conference and Council Meeting, School Libraries Section, Paris, 1989.

APPENDIX C

SCHOOLS IN THE SAMPLE

SCHOOLS IN THE SAMPLE

There are 221 cases in the sample for this study. Schools included in this sample are those which met two criteria: they responded to the 1988-89 Survey of School Library Media Centers in Colorado and they used the *Iowa Tests of Basic Skills* or *Tests of Achievement and Proficiency*. Regarding the first criterion, note that not all schools in a given district are necessarily reported. Regarding the second criterion, note that, in a few cases, a school appears twice, because it includes two of the grades for which test scores were reported.

COUNTY	DISTRICT	LEVEL	SCHOOL
ADAMS	BENNETT	ES	BENNETT
ADAMS	STRASBURG	ES	STRASBURG
ADAMS	STRASBURG	JSH	STRASBURG
ADAMS	STRASBURG	JSH	STRASBURG
ADAMS	WESTMINSTER	ES	DAY
ADAMS	WESTMINSTER	ES	HARRIS PARK
ADAMS	WESTMINSTER	ES	METZ
ADAMS	WESTMINSTER	ES	SHERRELWOOD
ADAMS	WESTMINSTER	JH/MS	CARPENTER
ADAMS	WESTMINSTER	JH/MS	CLEAR LAKE
ADAMS	WESTMINSTER	JH/MS	SHAW HEIGHT
ADAMS	WESTMINSTER	SHS	RANUM
ADAMS	WESTMINSTER	SHS	WESTMINSTER
ARAPAHOE	CHERRY CREEK	ES	ARROWHEAD
ARAPAHOE	CHERRY CREEK	ES	CHERRY HLLS VIL
ARAPAHOE	CHERRY CREEK	ES	COTTONWOOD CRK
ARAPAHOE	CHERRY CREEK	ES	CREEKSIDE
ARAPAHOE	CHERRY CREEK	ES	GREENWOOD
ARAPAHOE	CHERRY CREEK	ES	HIGH PLAINS
ARAPAHOE	CHERRY CREEK	ES	HOLLY HILLS
ARAPAHOE	CHERRY CREEK	ES	HOMESTEAD
ARAPAHOE	CHERRY CREEK	ES	INDEPENDENCE
ARAPAHOE	CHERRY CREEK	ES	INDIAN RIDGE
ARAPAHOE	CHERRY CREEK	ES	MEADOW POINT
ARAPAHOE	CHERRY CREEK	ES	MISSION VIEJO
ARAPAHOE	CHERRY CREEK	ES	SUMMIT
ARAPAHOE	CHERRY CREEK	ES	SUNRISE
ARAPAHOE	CHERRY CREEK	ES	VILLAGE EAST

COUNTY	DISTRICT	LEVEL	SCHOOL
ARAPAHOE	CHERRY CREEK	ES	WALNUT HILLS
ARAPAHOE	CHERRY CREEK	ES	WILLOW CREEK
ARAPAHOE	CHERRY CREEK	JH/MS	CAMPUS MID UNIT
ARAPAHOE	CHERRY CREEK	JH/MS	HORIZON
ARAPAHOE	CHERRY CREEK	JH/MS	LAREDO
ARAPAHOE	CHERRY CREEK	SHS	CHERRY CREEK
ARAPAHOE	CHERRY CREEK	SHS	OVERLAND
ARAPAHOE	CHERRY CREEK	SHS	SMOKY HILL
CONEJOS	N CONEJOS	ES	LA JARA
CONEJOS	N CONEJOS	ES	MANASSA
CONEJOS	N CONEJOS	SHS	CENTAURI
CROWLEY	CROWLEY	ES	CROWLEY CO
CROWLEY	CROWLEY	JH/MS	CROWLEY CO
CROWLEY	CROWLEY	SHS	CROWLEY CO
DENVER	DENVER	ES	FALLIS
DENVER	DENVER	ES	BRADLEY
DENVER	DENVER	ES	BROWN
DENVER	DENVER	ES	CENTENNIAL
DENVER	DENVER	ES	COLOMBIAN
DENVER	DENVER	ES	CORY
DENVER	DENVER	ES	CROFTON
DENVER	DENVER	ES	DEL PUEBLO
DENVER	DENVER	ES	EAGLETON
DENVER	DENVER	ES	EDISON
DENVER	DENVER	ES	ELLIS
DENVER	DENVER	ES	FAIRVIEW
DENVER	DENVER	ES	GODSMAN
DENVER	DENVER	ES	GOLDRICK

COUNTY	DISTRICT	LEVEL	SCHOOL
DENVER	DENVER	ES	HALLETT
DENVER	DENVER	ES	KNIGHT FUNDL
DENVER	DENVER	ES	MCKINLEY
DENVER	DENVER	ES	MITCHELL
DENVER	DENVER	ES	MOORE
DENVER	DENVER	ES	NEWLON
DENVER	DENVER	ES	OAKLAND
DENVER	DENVER	ES	PHILIPS
DENVER	DENVER	ES	ROSEDALE
DENVER	DENVER	ES	SABIN
DENVER	DENVER	ES	SAMUELS
DENVER	DENVER	ES	SMEDLEY
DENVER	DENVER	ES	STEELE
DENVER	DENVER	ES	SWANSEA
DENVER	DENVER	ES	TELLER
DENVER	DENVER	ES	VALDEZ
DENVER	DENVER	ES	WEBSTER
DENVER	DENVER	JH/MS	BAKER
DENVER	DENVER	JH/MS	KEPNER
DENVER	DENVER	JH/MS	KING
DENVER	DENVER	JH/MS	LAKE
DENVER	DENVER	JH/MS	MERRILL
DENVER	DENVER	JH/MS	MOREY
DENVER	DENVER	JH/MS	PLACE
DENVER	DENVER	JH/MS	SKINNER
DENVER	DENVER	SHS	EAST
DENVER	DENVER	SHS	JEFFERSON
DENVER	DENVER	SHS	LINCOLN

COUNTY	DISTRICT	LEVEL	SCHOOL
DENVER	DENVER	SHS	MANUAL
DENVER	DENVER	SHS	MONTBELLO
DENVER	DENVER	SHS	NORTH
DENVER	DENVER	SHS	WASHINGTON
DENVER	DENVER	SHS	WEST
DENVER	DENVER	K12	BOETTCHER
EL PASO	FOUNTAIN	ES	ABRAMS
EL PASO	FOUNTAIN	ES	FOUNTAIN MESA
EL PASO	FOUNTAIN	ES	JORDAHL
EL PASO	FOUNTAIN	JH/MS	ARAGON
EL PASO	FOUNTAIN	SHS	FOUNTAIN
EL PASO	LEWIS-PALMER	ES	KILMER
EL PASO	LEWIS-PALMER	ES	LEWIS-PALMER
EL PASO	LEWIS-PALMER	ES	PALMER LAKE
EL PASO	LEWIS-PALMER	JH/MS	LEWIS-PALMER
EL PASO	LEWIS-PALMER	SHS	LEWIS-PALMER
EL PASO	PEYTON	K12	PEYTON
EL PASO	PEYTON	K12	PEYTON
EL PASO	PEYTON	K12	PEYTON
ELBERT	AGATE	JSH	AGATE
ELBERT	ELIZABETH	ES	RUNNING CREEK
ELBERT	ELIZABETH	JSH	ELIZABETH
ELBERT	ELIZABETH	JSH	ELIZABETH
ELBERT	KIOWA	K12	KIOWA CONS
ELBERT	KIOWA	K12	KIOWA CONS
JACKSON	NORTH PARK	ES	WALDEN
JACKSON	NORTH PARK	JSH	NORTH PARK
JEFFERSON	JEFFERSON	ES	BELMAR

COUNTY	DISTRICT	LEVEL	SCHOOL
JEFFERSON	JEFFERSON	ES	CAMPBELL
JEFFERSON	JEFFERSON	ES	COLUMBINE HILLS
JEFFERSON	JEFFERSON	ES	DAVIS
JEFFERSON	JEFFERSON	ES	DUTCH CREEK
JEFFERSON	JEFFERSON	ES	FITZMORRIS
JEFFERSON	JEFFERSON	ES	FOOTHILLS
JEFFERSON	JEFFERSON	ES	FOSTER
JEFFERSON	JEFFERSON	ES	FREMONT
JEFFERSON	JEFFERSON	ES	GLENNON HTS
JEFFERSON	JEFFERSON	ES	GREEN GABLES
JEFFERSON	JEFFERSON	ES	GREEN MOUNTAIN
JEFFERSON	JEFFERSON	ES	KENDALLVUE
JEFFERSON	JEFFERSON	ES	KENDRICKS LAKES
JEFFERSON	JEFFERSON	ES	KULLERSTRAND
JEFFERSON	JEFFERSON	ES	MARTENSEN
JEFFERSON	JEFFERSON	ES	MITCHELL
JEFFERSON	JEFFERSON	ES	MOLHOLM
JEFFERSON	JEFFERSON	ES	PECK
JEFFERSON	JEFFERSON	ES	PLEASANT VIEW
JEFFERSON	JEFFERSON	ES	SECREST
JEFFERSON	JEFFERSON	ES	SLATER
JEFFERSON	JEFFERSON	ES	STOBER
JEFFERSON	JEFFERSON	ES	TANGLEWOOD
JEFFERSON	JEFFERSON	ES	VANDERHOOF
JEFFERSON	JEFFERSON	ES	WELCHESTER
JEFFERSON	JEFFERSON	ES	WESTGATE
JEFFERSON	JEFFERSON	JH/MS	WHEAT RIDGE
JEFFERSON	JEFFERSON	JH/MS	ARVADA

COUNTY	DISTRICT	LEVEL	SCHOOL
JEFFERSON	JEFFERSON	JH/MS	DEER CREEK
JEFFERSON	JEFFERSON	JH/MS	EVERGREEN
JEFFERSON	JEFFERSON	JH/MS	EVERITT
JEFFERSON	JEFFERSON	JH/MS	MANDALAY
JEFFERSON	JEFFERSON	JH/MS	N ARVADA
JEFFERSON	JEFFERSON	JH/MS	OCONNELL
JEFFERSON	JEFFERSON	JH/MS	W JEFFERSON
JEFFERSON	JEFFERSON	SHS	ARVADA
JEFFERSON	JEFFERSON	SHS	ARVADA W
JEFFERSON	JEFFERSON	SHS	BEAR CREEK
JEFFERSON	JEFFERSON	SHS	CHATFIELD
JEFFERSON	JEFFERSON	SHS	COLUMBINE
JEFFERSON	JEFFERSON	SHS	GREEN MOUNTAIN
JEFFERSON	JEFFERSON	SHS	JEFFERSON
KIOWA	PLAINVIEW	K12	PLAINVIEW
KIOWA	PLAINVIEW	K12	PLAINVIEW
LA PLATA	DURANGO	ES	FLORIDA MESA
LA PLATA	DURANGO	ES	FT LEWIS MESA
LA PLATA	DURANGO	ES	NEEDHAM
LA PLATA	DURANGO	ES	PARK/MASON
LA PLATA	DURANGO	ES	RIVERVIEW
LA PLATA	DURANGO	ES	SUNNYSIDE
LA PLATA	DURANGO	JH/MS	MILLER
LA PLATA	DURANGO	JH/MS	SMILEY
LA PLATA	DURANGO	SHS	DURANGO
LARIMER	POUDRE	ES	BAUDER
LARIMER	POUDRE	ES	CACHE/POUDRE
LARIMER	POUDRE	ES	HARRIS

COUNTY	DISTRICT	LEVEL	SCHOOL
LARIMER	POUDRE	ES	JOHNSON
LARIMER	POUDRE	ES	LAUREL
LARIMER	POUDRE	ES	LOPEZ
LARIMER	POUDRE	ES	MOORE
LARIMER	POUDRE	ES	RIFFENBURGH
LARIMER	POUDRE	JH/MS	LESHER
LARIMER	POUDRE	SHS	POUDRE
MINERAL	CREEDE	K12	CREEDE
MINERAL	CREEDE	K12	CREEDE
MONTEZUMA	CORTEZ	ES	MANAUGH
MONTEZUMA	CORTEZ	ES	BEECH ST
MONTEZUMA	CORTEZ	ES	BEECH ST K
MONTEZUMA	CORTEZ	ES	DOWNEY
MONTEZUMA	CORTEZ	ES	KEMPER
MONTEZUMA	CORTEZ	ES	LAKEVIEW
MONTEZUMA	CORTEZ	ES	LEWIS-ARRIOLA
MONTEZUMA	CORTEZ	SHS	CORTEZ
MONTEZUMA	MANCOS	K12	MANCOS
MONTEZUMA	MANCOS	K12	MANCOS
MONTEZUMA	MANCOS	K12	MANCOS
MONTROSE	MONTROSE	ES	JOHNSON
MONTROSE	MONTROSE	JSH	OLATHE
MONTROSE	MONTROSE	JH/MS	COLMBINE
MONTROSE	MONTROSE	SHS	MONTROSE
MONTROSE	WEST END	ES	NUCLA
MONTROSE	WEST END	JH/MS	NATURITA
MONTROSE	WEST END	SHS	NUCLA
OTERO	E OTERO	ES	WEST

COUNTY	DISTRICT	LEVEL	SCHOOL
OTERO	E OTERO	SHS	LA JUNTA
PITKIN	ASPEN	ES	ASPEN
PITKIN	ASPEN	JH/MS	ASPEN
PITKIN	ASPEN	SHS	ASPEN
PROWERS	LAMAR	JH/MS	LAMAR
PROWERS	LAMAR	SHS	LAMAR
ROUTT	S ROUTT	ES	SOUTH ROUTT
SAN MIGUEL	NORWOOD	K12	NORWOOD
SAN MIGUEL	NORWOOD	K12	NORWOOD
SAN MIGUEL	NORWOOD	K12	NORWOOD
TELLER	CRIPPLE CREEK	K12	CRIPPLE CREEK
TELLER	CRIPPLE CREEK	K12	CRIPPLE CREEK
TELLER	WOODLAND PARK	ES	GATEWAY
WASHINGTON	WOODLIN	K12	WOODLIN
WASHINGTON	WOODLIN	K12	WOODLIN
WELD	AULT-HIGHLAND	JH/MS	HIGHLAND
WELD	AULT-HIGHLAND	ES	HIGHLAND
WELD	AULT-HIGHLAND	JH/MS	HIGHLAND
WELD	AULT-HIGHLAND	JSH	HIGHLAND
WELD	BRIGGSDALE	K12	BRIGGSDALE
WELD	BRIGGSDALE	K12	BRIGGSDALE
WELD	FT LUPTON	ES	BUTLER
WELD	FT LUPTON	ES	TWOMBLY PRI
WELD	PRAIRIE	K12	PRAIRIE
WELD	PRAIRIE	K12	PRAIRIE

APPENDIX D

SURVEY OF SCHOOL LIBRARY MEDIA CENTERS IN COLORADO, 1988-89

SURVEY OF SCHOOL LIBRARY MEDIA CENTERS IN COLORADO, 1988-89

School						Person Completing					
School District (including county name)											
Circle grades served by the LMC:											
1	2	3	4	5	6	7	8	9	10	11	12

NOTE: Complete all items requesting annual figures using the most recent annual data available--may be either school or calendar year. Per typical week items may be completed by reporting a count for a single selected week, the total of counts for five non-consecutive days, or the average for two or more weeks. The choice among these three methods should be guided by the judgment of library media staff as to which method will yield the most representative results.

Item	Description	Number
1	Number of **HOURS** per typical week **LMC** is **OPEN**	
	Number of **STAFF HOURS PER TYPICAL WEEK** worked by	
2	Person(s) with media endorsement or 18 or more semester hours of library media courses	
3	Certified teacher(s) without media endorsement or less than 18 semester hours of library media courses	
4	Other paid library media staff who are neither endorsed media professionals nor certified teachers (e.g., paraprofessionals)	
5	Volunteer(s) (includes unpaid students)	

For each of the following types of **CONTINUING EDUCATION HOURS**, report the sum of the number of hours taken by all paid library media staff during the year.

6	Hours of courses taken for college or university credit	Library Media	Other
6a	semester hours		
6b	quarter hours		
7	Contact hours of continuing education from all other sources (e.g., district, BOCES, regional library system, CEMA, CLA)		
8	Are any costs of participating in continuing education (e.g., registration fees, books, travel) paid by the school or school district? Circle one:	YES	NO

LMC MATERIALS (whether or not housed in LMC)

For items 9-12, indicate from most recent inventory or estimate as follows:

- If over 1,000, estimate to the nearest 1,000
- if 100-1,000, estimate to the nearest 100
- If under 100, estimate to the nearest 10.

Item	Description	Number
9	Number of books	
10	Number of video cassettes	
11	Number of computer software packages	
12	Number of other audio-visual materials (e.g., audio cassettes, slide sets, films	
13	Number of current periodical subscriptions	
14	Number of microcomputers under LMC jurisdiction	

LMC SERVICES PER TYPICAL WEEK

15	LMC visits (including students and staff)	
16	Circulation of books	
17	Circulation of non-print items	
18	Instructional uses of microcomputers under LMC jurisdiction	
19	Materials received from any source outside the school building (e.g., interlibrary loan, rental)	
20	Individuals receiving library instruction (whether in groups or one-to-one)	
21	Hours spent identifying materials to support instructional units developed by teachers	
22	Hours spent in planning instructional units with teachers	

LIBRARY/INFORMATION SKILLS INSTRUCTION

23	Indicate how library/information skills are taught by circling the code following the most appropriate response:	
23a	Separate formal curriculum	1
23b	Integrated throughout school curriculum	2
23c	Both	3
23d	Either	4

INFORMATION DELIVERY

Item	Description	
24	Indicate which of the following methods are used to deliver instructional media information to teachers, administrators, and parents. Check as many as apply:	
24a	face-to-face, one-to-one conferences	
24b	newsletters, bibliographies, memos	
24c	announcements at meetings	
24d	displays	
24e	demonstration/instruction	
24f	mass media	

LMC USE

25	Indicate how classes use the LMC by circling the code(s) following all responses which apply:	
25a	Classes visit the LMC on a fixed schedule.	1
25b	Classes visit the LMC on a need basis.	2
25c	Students visit the LMC independently.	3

LMC AUTOMATION

26	Indicate which of the following LMC functions are computerized by checking as many as apply:	
26a	Patron access catalog	
26b	LMC administration (office automation)	
26c	Circulation	
26d	Interlibrary loan	
26e	Cataloging	
26f	Database searching	
26g	Network access to other libraries	

LMC EXPENDITURES

Please report funds from all sources (e.g., school district funds from state and federal sources, Parent Teacher Association donations, other gifts) which were actually expended on LMC materials and equipment during the year.

Item	Description	Dollars
27	Actual expenditures on LMC materials	$ .00
28	Actual expenditures on LMC equipment	$ .00
29	Are federal funds, such as ECIA, Chapter 2, used to support the LMC in this building? Circle one:	YES NO

STUDY TEAM

Keith Curry Lance	Library Research Service
Lynda Welborn	School Library Media Development
Christine Hamilton-Pennell	CDE Resource Center

ADVISORY COMMITTEE

Eric Feder	Colorado Department of Education
Deborah Kirk	Greeley School District 6
Wayne Martin	Colorado Department of Education
Jane Miller	Arkansas Valley Regional Library System
Pat Neel	Cherry Creek School District
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